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Electrical World

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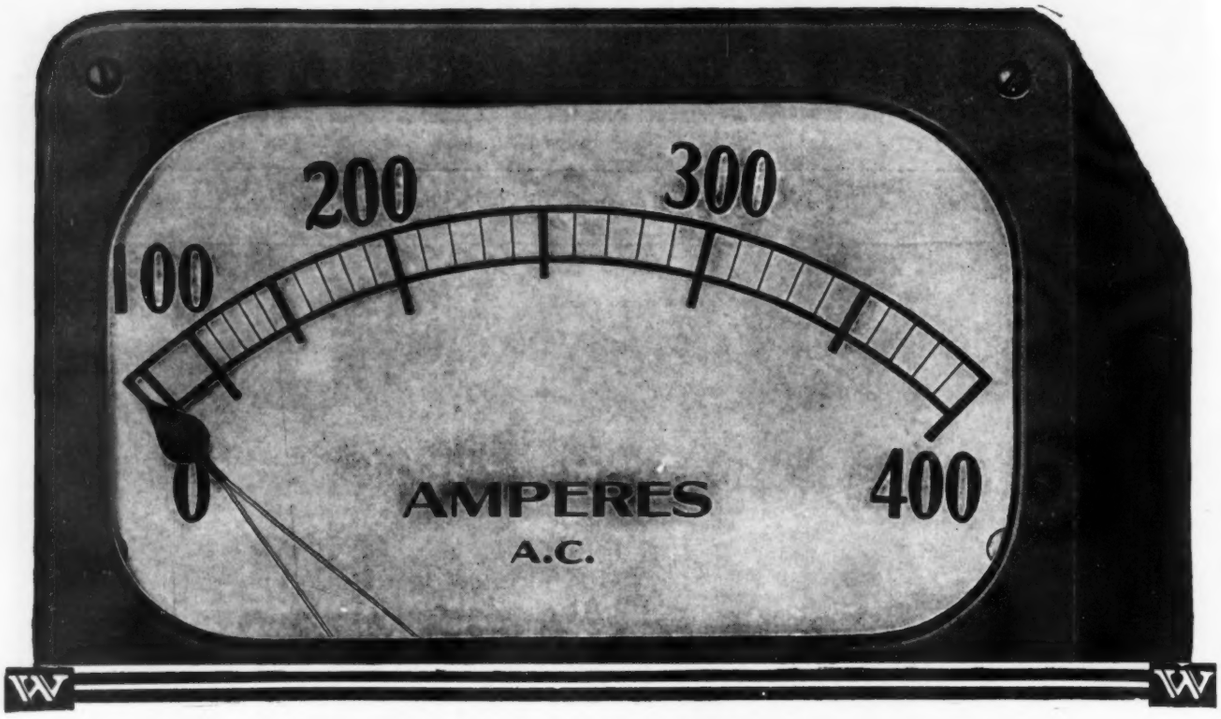

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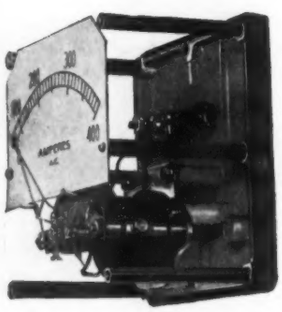

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WESTON

STANDARD - The World Over

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Owen D. Young— Master Builder

INAUGURATION of the far-reaching financial plan which is confidently expected to bring about world rehabilitation has been intrusted to Owen D. Young, an American citizen and an honored leader of the electrical industry. That this great responsibility would fall to him has been seen on the horizon for some time, and the world has long agreed that his hands are the most competent for building the economic highway whose foundations are laid in the Dawes plan.

The career of this master builder from farm boy to international dictator has been a continuous triumph of personality and brains. His resourceful mind, winning personality, studious habits and strategic leadership have led to success after success in industrial affairs, and when later devoted to international counsels resulted in a unanimous agreement on his qualifications to make the Dawes plan the salvation of war-torn Europe.

The electrical industry wishes Mr. Young well in his great and difficult task and hopes he will lead the nations out of the slough of despair into the broad highway of economic prosperity. And when he returns to this country it will welcome his re-entry into its intimate councils, where his vision, wisdom and leadership can again help build the electrical structure.

American Money Sought for Foreign Developments

ALTHOUGH Switzerland has floated enormous loans in this country, $50,000,000 in all, presumably for the electrification of her railroads, and loans have been made for electrical developments near Milan, Italy, not many foreign systems have succeeded in raising funds here because of the instability of the several governments. Certainly, as soon as the new German loan is floated money will become scarce for a while in this country and consequently high in price; hence the necessity of quick action on the part of electric light and power companies in need of money for new developments or for refunding operations. The Lower Austrian Hydro-Electric Power Company sold $30,000,000 of closed first mortgage sinking-fund gold bonds in New York last week, the first industrial loan to Austria since the war, and undoubtedly other Austrian and Italian loans in hydro-electric developments will be offered. Both Austria and Italy are rich in water and poor in coal, and markets are available for all the power. Foreign capital will be needed for these enterprises, and naturally all eyes are turned toward the United States. Austria needs 15,500,000 tons of coal yearly of which 12,000,000 tons must be imported at an approximate cost of $80,000,000. When fully developed Austria's water powers will produce the equivalent of 8,900,000 tons of coal, and the value of the electricity has been roughly estimated at $60,000,000 a year. Restricted in area as it now is, Austria stands fourth among European countries as regards available water power in proportion to its population and second in proportion to its area. The Italian and Austrian water powers, as well as their markets for electricity, are attractive and merit consideration.

State Ownership Waning in Europe

IN MOST of the countries of Europe the telephone and telegraph systems are state-owned. Those who have had occasion to use the telephone, particularly in France, Spain and Italy, know only too well that the service exceeds in badness all the abominations spoken of by the prophets. The unsatisfactory conditions in the French telephone service have given rise to wide criticism and even to proposals that the telegraph and telephone services be taken out of the hands of the government and turned over to private companies. The government is fully aware of the necessity of marked improvement to modernize the service.

In speaking of the telephone service of France the Reporter-General declared it to be a "dishonor to the country." City service is vexatious, and interurban lines are so deficient that they may be said almost not to exist. Italy under Mussolini has already turned to private ownership for relief, and now Spain follows Italy's example. Last week King Alfonso signed a decree authorizing the execution of a contract already approved by the military directorate for the construction and operation of a general telephone system throughout Spain. It is interesting to note that in both Italy and Spain operations will follow the lines of American telephone systems and that American apparatus will largely be employed.

The Franklin Institute Centenary

THE centenary celebration of the founding of the Franklin Institute on September 17, 18 and 19 will bring together from Europe and America outstanding men in science and engineering to pay homage to an institution which has rendered major services and which is unique in this country. Founded by two young men of science—Samuel Vaughan Merrick and William Hypolitus Keating—it has grown and developed through three generations and has engraved on its roll of honorable accomplishments achievements which brought

worldwide fame and gave untold aid to science and civilization.

Even in 1824 the Institute had a membership of more than fifteen hundred and wielded a strong influence on science and industrial art. Its purpose was always to help younger scientists to success and to encourage those who already had established reputations. Early in its career it instituted the first school for mechanical drawing in Philadelphia and the first high school. It established lecture courses in naval architecture, mathematics and the sciences. It afforded facilities for research work, and in its halls Elihu Thomson and Edwin J. Houston built their first arc-lighting generators. Under the inspiration of William and Coleman Sellers the Institute secured the adoption of the United States standard screw thread. From the first it created a library which has grown to be one of the finest in the world, and along with the library came the *Journal*, whose pages are enriched with the published results of research in science from contributors in all parts of the world.

Without bias and without fear, the Franklin Institute has stood for the cause of science throughout the years, and the tributes that will be paid it in September by Rutherford, Parsons, Millikan and others will be echoed by the whole scientific and industrial world. The electrical industry takes particular pride in the anniversary because the president of the Franklin Institute at the time of the centennial is one of its honored leaders.

New Data on Cable-Sheath Corrosion

SELF-CORROSION of lead cable sheaths has given trouble to the electrical industry for many years and forced the adoption of many costly types of installation. Early in the art it was found that the best protection against corrosion was the installation of lead cables so that the sheath could not come into contact with the soil, and hence clay tile and asphaltic or pitch ducts became a necessary part of underground installations. Some very valuable data and conclusions on cable corrosion have been obtained recently by F. O. Anderegg and R. V. Achatz of the engineering experiment station of Purdue University. The results were printed in Bulletin No. 18 of the engineering experiment station and give the details of laboratory and field tests made to secure these data.

The most prolific cause of sheath corrosion is the presence of organic matter in the soil. This decomposes and produces acids which attack the cable sheaths; in particular, acetic acid is nearly always produced from decaying wood and vegetable matter. Alkali in the form of limestone, concrete, gypsum, etc., will cause corrosion in some cases and usually increases the rate of corrosion. Corrosion rate is also affected by the soil-drainage characteristics.

Tin-lead alloy sheaths were found much more resistant to corrosion than pure lead sheaths, but the antimony-lead-alloy sheath was found less resistant to corrosion than pure lead. The conclusions are drawn that the only effective means of preventing sheath corrosion is to separate the sheaths from the soil, and this is effective only if the tile or other ducts are complete and continuous. The use of concrete, untreated wood or limestone in direct contact with or in the near vicinity of lead-covered cables should therefore be scrupulously avoided.

The results of these studies indicate that lead-covered cables must continue to be installed in ducts, and hopes of reducing underground installation costs very materially lie in the direction of producing a cable sheath that is non-corrosive and which conforms to the other economic and engineering requirements of underground service. It is to be hoped that metallurgical work on non-corrosive sheaths will be carried on until the field is thoroughly investigated.

Consumers and Customers

FOR the individual dealer in electrical supplies the consumer is not necessarily a customer. He addresses his newspaper advertising, his letters and his window displays to that group known as consumers. His hope is that he will attract them to his store. His problem is then to make them his customers. He speaks a different language to those undefined consumers from that he should use to the materialized consumers who give him an opportunity to make them his customers. His efforts, whether embodied in advertisements, circulars or window displays, are designed to gain attention. The lure may be anything legitimate, but it must be a lure. It may be spectacular, it may have an educational tone, it may be a promise of service.

When the consumer materializes, the dealer's dominant note must include helpfulness, convenience and efficiency; that is, service. Too often he does not distinguish between the consumer and the customer. When he has enticed consumers to his store, merchandise should be visibly displayed. It is a real aid to the prospective customer to see lamps, wiring devices, batteries and other articles systematically displayed before him. Names, numbers and other commercial designations mean little to him. He may not know what he wants. At best he may have a vague form in his mind's eye but not the name on his tongue. Knowledge on the part of the salesman in regard to wiring, lamps, fixtures, wiring devices, batteries and so forth also helps make a customer out of the consumer. There are too many electrical stores where some one fumbles in drawers or boxes for merchandise out of sight and fumbles mentally as well for answers to questions addressed to him by the confused would-be customer.

All progress eventually must pass through commercial highways. Unfortunately these are the worst roadbeds in the electrical business. The scientist has done his part well, the manufacturer has developed and supplied satisfactory merchandise, the engineer has built a modern central station which is operating with efficiency; but the consumer, when he must be a customer, passes along the commercial highway and the going is too often rough. The "highway commission" of the electrical industry has done a great deal of excellent work. Extensions are being pushed all the time, but where the traffic is greatest the most repairs are needed. The commercial highways are not so satisfactory as they should be.

The scientific, technical and manufacturing interests of the electrical industry realize that the pace of the whole industry cannot exceed that of the slowest por-

tion. The commercial interests are in contact with the consumer and in a strategic position to see that he gets his full share of the blessings of electricity. The central-station company is not usually in the same position. For it consumers and customers are equal in number and identical. But in addressing the consumer group it is easy to become impersonal and to remain so when addressing materialized consumers—the customers. Central stations, too, have a commercial highway to care for. This highway in some places is independent, but in others it is parallel to that of the dealer. How unjust it is to the other interests if both these highways are in bad shape! Let no one forget that all progress must pass eventually along the commercial highways and that they need extension and attention.

Specialization and Breadth Both Needed

IN THE early days of electricity a brilliant group of scientists discovered and enunciated the laws underlying electrical phenomena. These men were the product of an educational system of an older age in which students were required to study and master all the sciences and humanities which had been codified in textbooks. These men were followed by a renowned group of engineers and scientists who applied the fundamental laws to the building of electrical equipment and to the application of this equipment to industrial needs. They were designers, builders and operators who received their education in the school of experience, in the laboratories and shops of industry.

In the present day there has arisen a group of engineers and scientists of two general types. One type is engaged in operating and directing large and complex engineering and industrial enterprises and the other is composed of men aptly called specialists. They devote their brains and knowledge to specialized branches of the electrical industry and attempt to solve the minute but important problems in each branch which stand in the way of better operation or greater efficiency. They know one branch of electricity and engineering better than any one else and in some cases find difficulty in stating their knowledge in language that can be understood by any except brother specialists in the same kind of activity.

These developments in science and engineering have been logical and valuable, but along with the present-day groups there should be developed the broadly scientific type of man in whose work lies hope of progress in the fundamental knowledge of electricity. The electrical industry should have men in the ranks who possess an expert knowledge of the electrical art as a whole so that they can do research work with a perspective and a knowledge which will augur well for fundamental discoveries in the broad field of electricity. There is hope for real progress if a modern Kelvin, Faraday or Maxwell is working in the vast unexplored territories of electrical science that there is every reason to believe still exist.

It is a long and difficult task to prepare men of this type. The extant knowledge of electrical science is vast and detailed—no four-year course in an engineering college is adequate preparation. But the electrical industry and the colleges should attempt the task and encourage those sufficiently ambitious and intelligent to embark on this type of scientific career. The rewards in prospect offer greater inducements than in years past and the men and facilities are available.

Making Commercial Hay While the Sun Isn't Shining

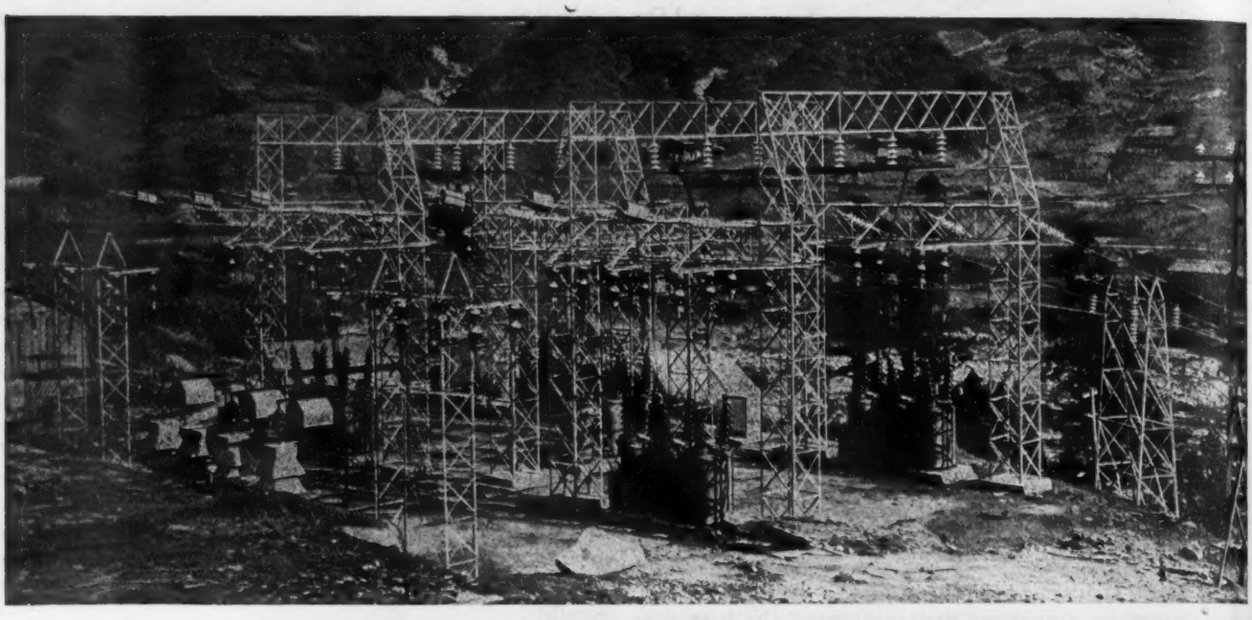
CONVERTING isolated-plant operators into users of central-station service is a hard task at best, but to "sign up" several new customers during an industrial slump is something of an accomplishment. Such, however, was the achievement of the Worcester (Mass.) Electric Light Company, which added three private plants to its lines during the past month. All of these "prospects" had received the usual reports from the company showing the savings to be made by central-station power, but they remained obdurate until the slackening of industrial activity made them see that they could no longer afford to operate their expensive private plants. Then they came to the Worcester company and asked that the service be cut in as soon as possible.

These circumstances afford matter for another page in the manual of the power salesman, and the business gained represents the fruit of missionary work on the part of the power sales department extending back perhaps ten years or more. It shows that when business is good a company can afford to be content with easily acquired business, but that when things slow down there is still business to be had.

Increased Revenue the Test of the Industry

THE true test of a business venture, no matter what its type, is revenue. Production as a whole may fall off, but if by reason of the increased cultivation of a certain type of buyers the gross revenue has increased and the expenses have not more than increased proportionately, then that business may be said to be in a prosperous condition. Such is the situation as it exists at present in the electric light and power industry; while output has slackened somewhat, income continues to increase.

In this issue will be found detail data on the operations of the industry for the first six months of this year and last year. Every section of the country reports a drop in energy sales materially below the decreases which occur each year from seasonal demand. From habit the industry has come to expect an annual growth, and when figures show the opposite to be true, it is distinctly depressing. But during the fall of 1923 and the spring of 1924 the industry benefited almost without effort on its own part from the great building boom which prevailed from coast to coast. Incomplete returns indicate that more than a million and three-quarters of new high-revenue domestic lighting customers were added to the central-station lines during the last twelve-month period. As a result of these additions, and despite the large curtailment of energy requirements by industry in general, the revenue of the industry is almost 10 per cent over that of last year. Energy consumption by the factories of New England during June is placed at 20 per cent under June of last year, but the gross revenue for this section during June was 3.3 per cent above last year. And the same story holds true for the other industrial sections of the country.

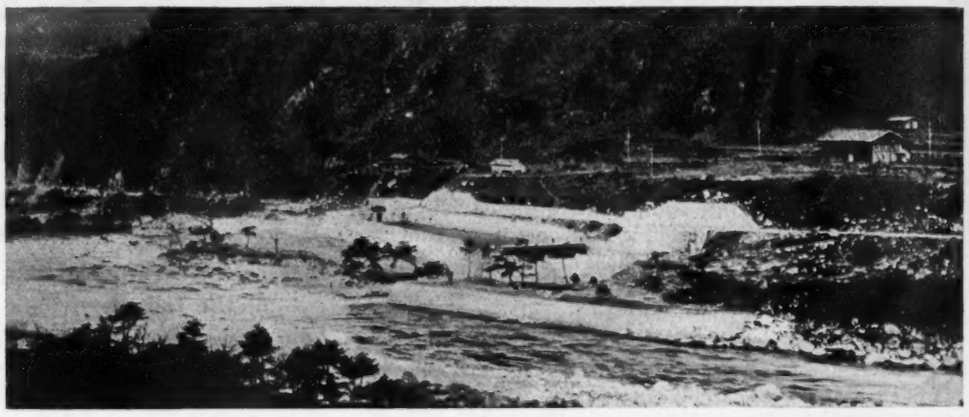


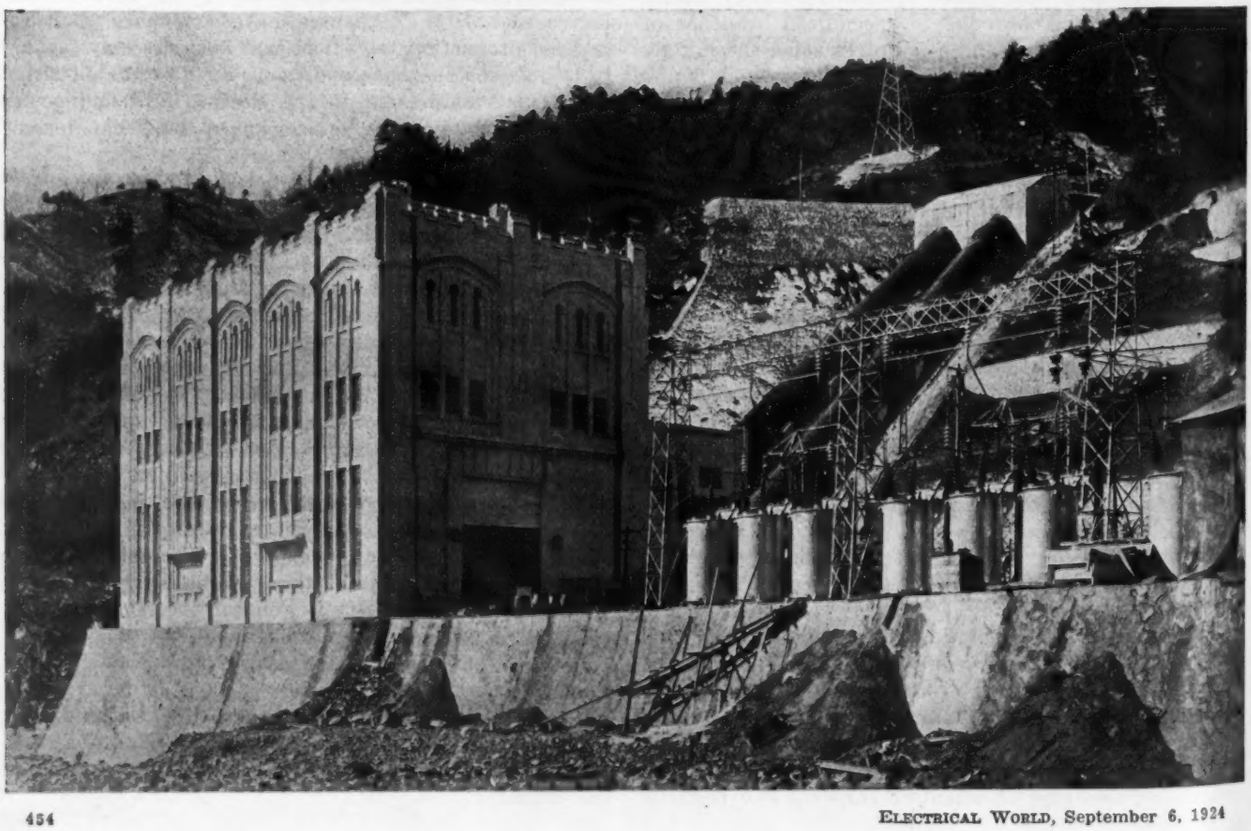
Japanese Hydro-Electric Practice

At top, a switching station on the 77,000-volt line.

Center view, a view of the concrete settling basin.

Below, the completed power house and outdoor switching station for the Momoyama plant.





Modern Japanese Hydro Plant

Description of the Momoyama Station of the Daido Electric Power Company—Details of Construction, Type of Equipment Used and Operating Conditions

BY S. KINUGAWA
Water Power Engineer Daido Electric Power Company, Tokyo, Japan

DIVERSION DAM AND INTAKE ON KISO RIVER

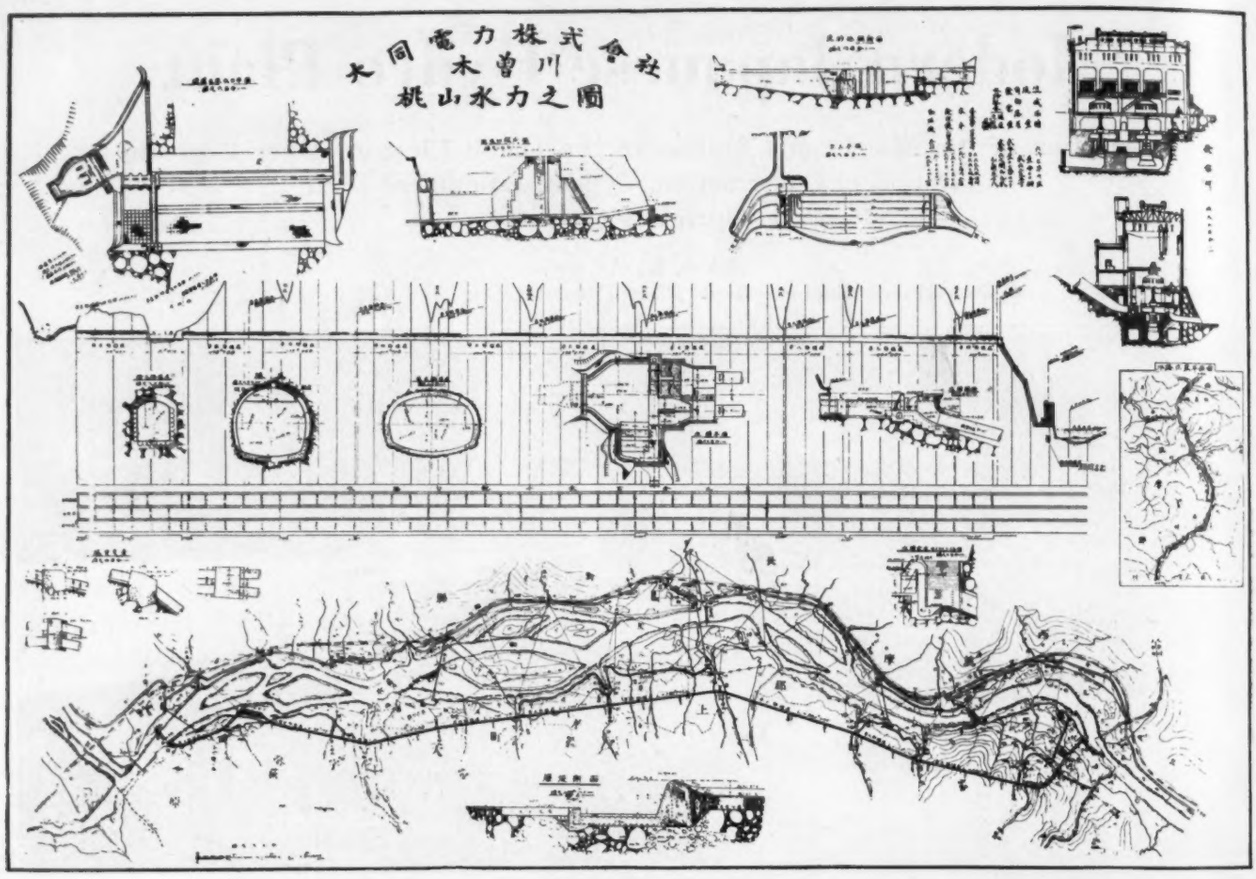
THE central portion of the mainland of Japan has many rivers of sharp gradient in the plateau of the so-called Japanese Alps. These rivers are advantageously situated with reference to the supply of electrical energy to the large cities and towns and have received primary consideration in the development of power resources. Of these rivers the Kiso is the most highly developed, and on this river the Daido Electric Power Company has several efficient plants. Three plants, totaling 34,900 kw., are in operation; two other plants, totaling 63,800 kw., have just been completed; one plant, totaling 42,900 kw., is under construction, and six plants, totaling 150,000 kw., are contemplated for future development.

The Momoyama plant is situated on the upper reaches of the river at a point about 160 miles from both Tokyo, the capital, and Osaka, the largest industrial city, and the energy generated is supplied to either of the two cities, according to the demand. A particular feature of the operating conditions, however, is that Tokyo and its district demand power at 50 cycles, while Osaka and its district use power at 60 cycles, and the new station is the first in Japan to attempt to supply power at different frequencies from the same plant.

HYDRO-ELECTRIC FEATURES

The accompanying engineering drawing, although containing Japanese characters, gives the general features of the development, including a cross-section and elevation of the power station and sections of the tunnel and dam. As is indicated above, the diversion weir is of masonry construction across the main river, having a total length of 282 ft., with a trapezoidal section, of which the crest is 12 ft. in width, the slope one to two at the rear, and a slope on the front of one to three-tenths. The total height is 19 ft. An apron construction of concrete 45.6 ft. long with a stone pitching is used to protect the weir, and at the end of the apron is constructed a crown 6 ft. long and 3 ft. higher than the normal surface. On the downstream side in the riverbed a concrete structure 42 ft. long has been made with cribwork to prevent the scouring action of the water. Three gates, each of which is 9 ft. wide and 10 ft. in height, constructed of steel, are installed at the intake side of the diversion weir. The waterway from the diversion weir enters into a settling basin through four steel regulating gates, each 9 ft. wide and 10 ft. high, which are protected by screens. The settling basin, which is at the head of tunnel No. 2, carries the water to the surge tank; it is 540 ft. long and has an effective depth of water of 23 ft. and a width of 68 ft. Four small drains with holes ¼ ft. in diameter approximately are constructed in the settling basin with steel gates at each end of the drains. In the settling basin there are two longitudinal walls to distribute the running water uniformly, and on the left-hand side a spillway is constructed.

The water is conducted to the surge tank in two tunnels whose section is of horseshoe form, and each of the two tunnels is constructed with a radius of the arch of 7.5 ft., radius of the side wall 18.75 ft., and contain a water depth of 12 ft. with a slope of one to twelve hundred. The lining is concrete, varying in thickness from 0.7 ft. to 1 ft. and 1.5 ft., according to the geological condition. The total length of each tunnel is 14,208 ft. A combined forebay and surge tank



DETAILS OF THE MOMOYAMA STATION

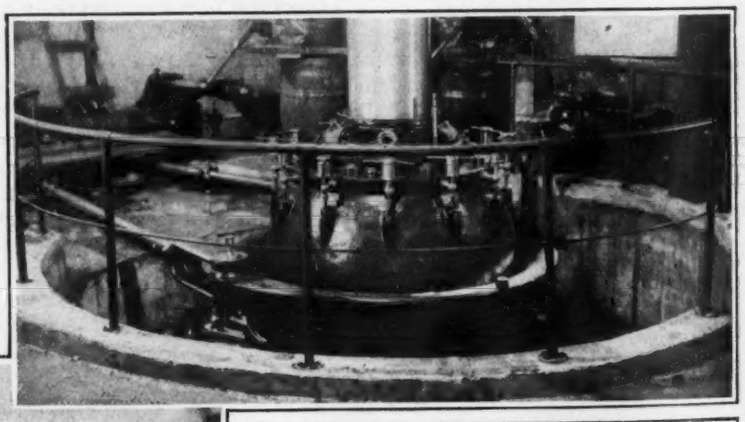
Above—An interesting Japanese engineering drawing for the Momoyama plant.

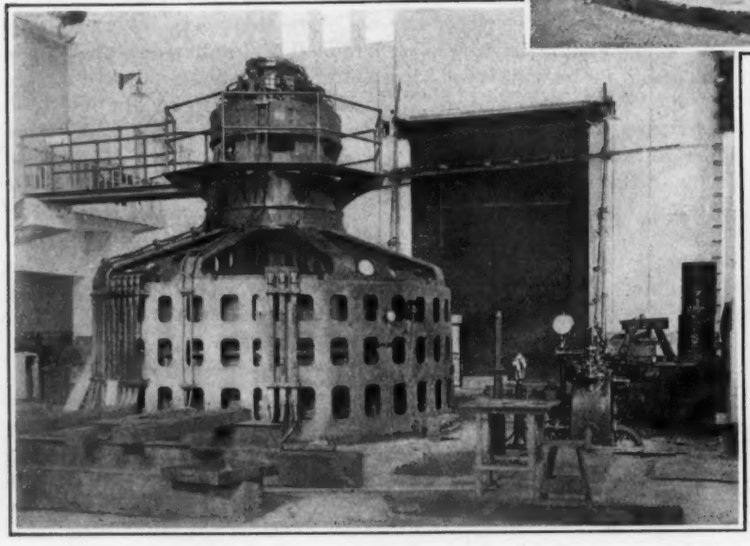
Japan relies very largely on waterpower for the supply of her industries and the recently built station on the Kiso River is representative of the modern installations found in all parts of the nation as shown in the three views below:

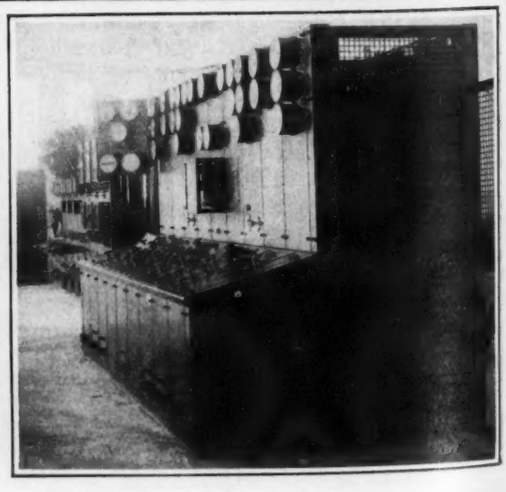
At right—A view of the turbine pit.

Below, at left—One of the 15,000-kva. generators which operate either 50 cycles or 60 cycles.

Below, at right—The switchboard of the Momoyama plant.







receives the water at the end of the tunnel and is constructed so that the water pool is normally 86½ ft. long, 58 ft. wide and 12 ft. deep. Four segmental roller gates are arranged at the end of the tank to regulate the quantity of the water taken by the two penstocks, and an iron screen is inserted in front of these gates. The walls of this surge tank are erected 5 ft. above the normal water surface to provide against surge action. In addition, on the right-hand side of the tank there is a siphon structure, in which are three siphons, each 4 ft. x 6 ft., having a suction head of 20 ft. They are made of reinforced concrete and carry away any excessive quantity of water to a tunnel 272 ft. long having a section 7 ft. wide and 8.5 ft. high.

POWER-HOUSE STRUCTURE

The power-house building is made of reinforced concrete, as indicated in the illustration on page 454, and contains a total floor area of 6,600 sq.ft. Of this area 4,335 sq.ft. is used by the generating room, 2,110 sq.ft. for the switchboard and the other part of the main floor for miscellaneous use. The basement portion contains the turbine and hydraulic equipment.

After emerging from the water-wheels, the water enters a tailrace 272 ft. long. The first 90 ft. of this tailrace has a varying section consisting of an open channel and culvert, with lengths of 30 ft. and 60 ft. respectively, and the remaining 182 ft. is a horseshoe-shaped tunnel having a constant section which is 18 ft. wide, 12 ft. high and built to a slope of one to one thousand.

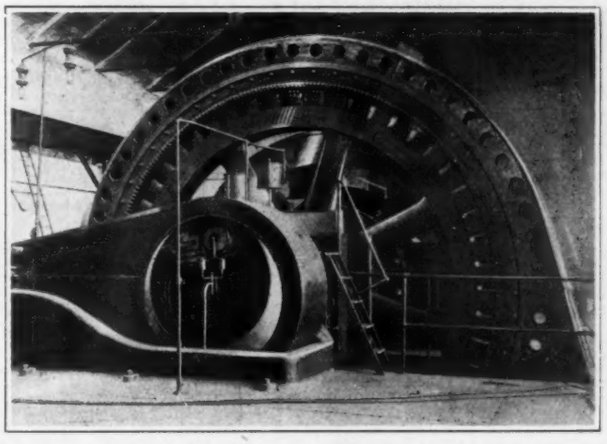
The water is conducted to the turbines through two riveted steel penstocks which have an inside diameter of 9 ft. 4 in. and a thickness varying from ⅜ to ⅞ in. Each is 673.76 ft. long. Anchor blocks and expansion joints are arranged at all points where the direction is changed, and small supporting blocks are placed at intervals varying from 18½ to 22 ft. The water from the two penstocks actuates two vertical single-spiral Francis turbines made by the Escher Wyss Company of Switzerland. These units are rated at 19,800 hp. each, operate at 250 r.p.m. or 300 r.p.m., depending on the frequency, and are equipped with an automatic oil-pressure system. The units drive two 15,000-kva., 6,600-volt, three-phase, 50-cycle to 60-cycle Westinghouse alternating-current generators having direct-connected 320-kw. exciters. The generators operate at a frequency of either 50 cycles or 60 cycles, using 300 r.p.m. for 60 cycles and 250 r.p.m. for 50 cycles. The windings are arranged so that by using a cross-star connection 60 cycles is obtained, or a star connection can be used for obtaining 50 cycles. Views of the control mechanism and of one of the generators are shown in the illustrations on page 456. The neutral of the generator is grounded through an oil breaker and has differential relay projection. The 6,600-volt busbars are divided into three sections by two oil breakers, and disconnecting switches are arranged on each side of the oil breaker. Oxide-film lightning arresters are used on each section of the 6,600-volt busbars, and a ground detector of the vacuum type is placed on the central section. For power for house-service use and to supply a reserve motor-generator set for excitation three 50-kva., 6,600-volt to 220/110-volt, 60-cycle or 50-cycle transformers are used.

The energy from the 6,600-volt busbars is taken to the outdoor transformer station shown on page 454. This station has a lattice-steel structure and contains seven 5,000-kva., 6,600-volt to 77,000-volt, single-phase, 50-cycle or 60-cycle transformers, which are connected delta-delta. These Westinghouse transformers are water-cooled and of the shell type. Automatic oil breakers with differential overload relays and with disconnecting switches on both sides of the breaker are arranged on the primary and secondary sides of the transformer. The energy, after being stepped up to 77,000 volts, goes out on a double-circuit steel-tower transmission line, which is equipped with oil breakers and balance relays on each circuit. In addition, choke coils and oxide-film arresters are placed on each circuit for protective purposes.

The energy from this station is delivered to Tokyo or Osaka, depending upon the power demand at different times.

Old Inductor-Alternators Help to Meet Power Shortage

A MODERN community in need of power is not interested in the type of equipment that generates it. To the engineer, however, the accompanying illustration of a Stanley inductor-alternator brings back memories of years gone by. This machine, with another one like it and three Bullock inductor-alternators, was recently placed in operation in the old Seventh and Central Streets steam plant of the Southern California



STEAM PLANT OF 1902 GOES INTO OPERATION IN LOS ANGELES

Edison Company to help meet the shortage of hydro-electric power in southern California caused by the driest year in the history of the state. This plant is one of many obsolete plants that have been rehabilitated and pressed into service. The equipment here was installed about twenty-two years ago, and the plant has been idle for eleven years. The machines are rated at 1,500 kw., 2,300 volts, 50 cycles, and each is driven by a cross-compound engine.

It is a strange coincidence that C. H. Hagey, one of the operators in the station twenty years ago, should again be operating the plant.

This incident shows the necessity for holding reserve equipment on central-station properties, for service must be maintained under all conditions. The reserve power of the electrical industry was also well exhibited in connection with the California water shortage. Four new steam stations were started and equipment built in record-breaking time through the energetic work of the Southern California Edison Company and equipment manufacturers.

TABLE I—CENTRAL STATION FINANCIAL OPERATIONS AND THE GENERATION AND DISTRIBUTION OF ENERGY BY SECTIONS OF THE COUNTRY FOR THE FIRST HALF OF 1923 AND 1924

(100 per Cent of the Industry)

Mos.	New England States			Atlantic States			North Central States			South Central States			Pacific and Mountain States		
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	Per Cent Inc.
Total Energy Generated (Thousands of Kw.-hr.)															
January	339,297	344,707	—1.6	1,771,960	1,619,461	9.4	1,502,018	1,351,420	11.1	325,602	280,564	16.0	853,827	760,914	12.3
February	322,517	310,058	4.1	1,651,845	1,467,006	12.7	1,377,828	1,217,147	13.2	301,708	256,478	17.9	816,255	715,589	14.0
March	*314,759	327,943	—4.0	1,693,699	1,596,875	6.1	1,422,170	1,331,896	6.8	303,766	281,731	7.9	861,558	792,759	8.7
April	*305,205	308,000	—1.0	1,598,459	1,513,522	5.5	1,318,333	1,244,025	5.9	291,990	262,582	11.2	837,133	767,482	9.0
May	*285,672	301,112	—5.2	1,574,154	1,560,894	0.8	1,321,646	1,269,988	4.0	301,067	274,580	9.5	929,543	858,616	8.3
June	*268,371	285,726	—2.5	1,486,684	1,523,827	—2.5	1,236,926	1,248,174	—0.9	300,486	266,893	12.4	927,717	839,707	10.4
Total for 6 mos.	1,835,821	1,877,546	—2.2	9,776,801	9,281,585	5.4	8,178,921	7,662,650	6.8	1,824,619	1,622,828	12.4	5,226,033	4,735,067	10.4
Total Energy Generated in Hydroelectric Plants (Thousands of Kw.-hr.)*															
March	125,416	120,451	4.1	631,771	551,455	14.4	233,600	222,886	0.3	111,032	93,438	18.7	613,241	699,317	—12.3
April	137,492	134,094	2.5	622,912	574,865	8.4	282,850	252,432	12.0	106,201	93,822	13.2	672,993	693,356	—8.8
May	141,163	136,786	3.2	609,486	593,038	2.7	305,855	281,963	8.4	107,653	101,391	6.2	750,844	769,084	—2.4
June	112,709	96,629	16.6	561,216	531,529	5.4	270,410	251,821	7.4	101,482	94,507	7.4	684,979	749,645	—8.7
Total Energy Generated in Fuel Burning Plants (Thousands of Kw.-hr.)*															
March	189,343	207,492	—8.6	1,061,928	1,045,420	1.5	1,198,570	1,109,010	8.1	192,734	188,293	2.3	248,317	93,442	165.3
April	167,713	173,906	—4.2	975,547	938,657	3.9	1,035,483	991,593	4.4	185,789	168,760	10.1	164,140	74,126	121.2
May	144,509	164,326	—12.1	964,668	967,856	—0.4	1,015,791	988,025	2.7	193,414	173,189	11.7	178,699	89,532	99.3
June	155,662	189,097	—17.7	925,468	992,298	—6.7	966,516	996,353	—3.0	199,004	172,386	15.4	242,738	90,062	169.8
Total Energy Consumed for Lighting (Thousands of Kw.-hr.)															
January	77,000	66,200	16.4	241,000	204,000	18.1	313,000	274,400	14.1	75,700	63,900	18.4	113,300	102,500	10.5
February	68,800	59,200	16.3	214,940	182,150	18.0	280,140	245,350	14.1	67,720	57,200	18.5	101,400	91,600	10.7
March	74,000	63,600	16.7	231,100	195,700	18.1	301,100	263,700	14.3	72,800	61,500	18.4	109,000	98,500	10.6
April	70,300	60,400	16.5	219,600	185,950	18.2	286,300	250,550	14.1	69,200	58,450	18.4	103,600	93,600	10.6
May	71,100	61,100	16.5	222,050	187,650	18.4	289,350	253,150	14.3	69,900	59,050	18.5	104,600	94,550	10.6
June	70,300	60,400	16.5	219,600	185,950	18.2	286,300	250,550	14.1	69,200	58,450	18.4	103,600	93,600	10.6
Total for 6 mos.	431,500	370,900	16.2	1,348,290	1,141,400	18.1	1,756,190	1,537,700	14.2	424,520	358,550	18.3	635,500	574,350	10.6
Total Energy Consumed for Power (Thousands of Kw.-hr.)															
January	152,097	169,707	—10.4	1,031,035	956,226	7.9	755,293	667,185	13.2	137,052	118,834	15.3	434,327	392,714	11.7
February	149,297	153,738	—2.8	975,535	859,636	13.4	696,118	611,477	13.8	126,168	108,758	16.2	424,755	374,789	13.5
March	135,959	159,093	—14.5	980,119	939,450	4.4	698,590	669,561	4.4	123,126	122,851	0.2	444,858	418,259	7.4
April	132,755	147,080	—9.7	919,799	885,747	3.9	630,773	613,050	2.8	117,560	109,992	6.9	432,033	403,682	7.4
May	114,832	139,722	—17.8	893,654	920,049	—2.8	629,546	628,843	0.2	121,947	117,420	3.7	497,503	468,666	6.4
June	103,751	129,636	—19.9	833,044	896,437	- 7.1	566,786	618,884	—8.5	124,286	113,503	9.5	500,617	458,307	9.7
Total for 6 mos.	788,691	898,976	—12.3	5,633,186	5,457,545	1.4	3,977,106	3,809,000	4.4	750,139	691,358	8.5	2,734,093	2,516,417	8.7
Total Energy Sold to Electric Railways (Thousands of Kw.-hr.)															
January	37,200	34,600	7.5	166,925	164,735	1.4	189,925	181,035	5.0	44,650	39,530	13.0	99,200	81,500	17.3
February	35,070	30,520	14.8	155,870	152,920	3.7	178,270	162,120	9.9	42,020	34,620	21.2	92,800	76,200	23.3
March	37,100	34,750	6.8	167,300	163,700	2.3	190,100	180,010	5.6	44,600	38,830	14.7	99,200	84,200	13.2
April	36,600	34,290	6.8	162,400	159,790	1.6	186,700	177,090	5.4	44,500	39,440	13.0	99,000	84,500	16.4
May	38,340	35,560	7.7	168,740	165,410	2.0	190,240	183,210	3.7	46,540	40,910	13.6	102,200	87,400	16.8
June	36,600	34,290	6.8	162,400	159,790	1.6	186,700	177,090	5.4	44,500	39,440	13.0	99,000	84,500	16.4
Total for 6 mos.	220,910	204,010	8.3	983,635	966,345	1.8	1,121,935	1,060,555	5.8	266,810	232,770	14.5	591,400	498,300	18.4
Total Energy Used in Intra-Company Business and Line Losses (Thousands of Kw.-hr.)															
January	73,000	74,200	—1.6	333,000	294,500	9.4	243,800	228,800	11.1	68,200	58,300	16.0	207,000	184,200	12.3
February	69,350	66,600	4.1	305,500	272,300	12.7	223,300	198,200	13.2	65,800	55,900	17.9	197,300	173,000	14.0
March	67,700	70,500	—4.0	315,180	298,025	6.1	232,380	218,625	6.8	63,240	58,550	7.9	208,500	191,800	8.7
April	65,550	66,230	—1.0	296,660	282,035	5.5	214,560	203,335	5.9	60,730	54,700	11.2	202,500	185,700	9.0
May	61,400	64,730	—5.2	289,710	287,785	0.8	212,510	204,785	4.0	62,680	57,200	9.5	225,200	208,000	8.3
June	57,720	61,400	—2.5	271,640	281,650	—2.5	197,140	201,650	—0.9	62,500	55,500	12.4	224,500	203,300	10.4
Total for 6 mos.	394,720	403,660	—2.2	1,811,690	1,716,295	5.4	1,323,690	1,255,395	6.8	383,150	340,150	12.4	1,265,000	1,146,000	10.4
Total Energy Purchased for Resale (Thousands of Kw.-hr.)															
January	74,000	77,100	—4.0	344,600	277,200	24.3	176,000	175,800	0.2	159,100	50,800	213.0	65,300	52,100	25.5
February	99,800	80,800	23.4	322,170	276,430	16.6	157,630	94,970	65.9	74,200	59,800	23.8	98,500	69,500	41.7
March	91,260	89,800	1.6	327,460	277,200	18.2	169,800	120,800	40.5	72,000	54,400	32.2	121,700	73,800	64.7
April	85,100	76,100	11.8	324,050	260,110	24.6	167,400	118,560	41.3	60,750	46,800	29.7	95,500	50,730	88.4
May	82,250	74,900	9.8	324,210	274,100	18.3	170,160	132,600	29.2	60,780	48,550	25.3	95,100	71,850	32.3
June	56,740	82,300	—31.2	299,200	244,000	22.8	164,000	135,700	20.8	60,850	57,400	6.2	112,200	80,800	38.7
Total for 6 mos.	489,150	481,000	1.7	1,941,690	1,609,040	20.6	1,004,990	778,430	28.4	487,680	317,750	53.8	588,300	398,780	47.6
Total Coal Consumption (Short tons)*															
March	153,524	169,756	—9.7	1,044,980	1,139,718	—8.3	1,415,955	1,217,745	16.3	117,162	124,586	—6.0	49,463	52,875	—6.5
April	129,729	138,150	—6.2	960,397	1,012,865	—5.2	1,226,390	1,246,704	—1.8	109,607	103,953	5.4	44,122	44,327	—0.7
May	122,687	130,305	—5.8	940,024	1,014,600	—7.3	1,189,081	1,233,862	—3.6	112,388	105,691	6.4	40,971	41,875	—2.2
June	130,576	193,541	—32.6	900,151	1,224,580	—26.5	1,135,029	1,356,703	—16.3	111,122	127,195	—12.6	39,493	45,658	—13.5
Total Oil Consumption (Barrels)*															
March	139,987	204,537	—31.4	128,225	125,792	1.9	150,229	162,310	—7.5	400,085	391,395	2.2	678,078	227,967	198.0
April	118,543	151,283	—21.6	113,869	106,404	6.9	134,380	144,295	—6.8	354,042	357,114	—0.8	465,945	174,280	167.2
May	105,656	160,240	—34.1	112,447	107,755	4.4	133,478	135,225	—1.3	324,114	359,031	—9.7	485,575	203,104	139.0
June	98,964	180,417	—45.2	113,688	106,068	7.2	93,395	136,258	—31.5	355,698	353,429	0.6	602,466	217,623	176.5
Total Gas Consumption (Thousands of cubic feet.)*															
March	0	0	0.0	161,996	210,161	—22.8	517,196	581,022	—11.0	995,837	952,200	4.6	1,424,375	489,371	191.0
April	0	0	0.0	132,134	198,445	—33.4	553,997	576,304	—3.9	1,173,747	1,013,289	15.8	871,323	420,129	107.3
May	0	0	0.0	135,141	230,720	—41.4	377,174	776,835	—51.5	1,397,485	1,053,565	32.4	998,567	570,878	74.8
June	0	0	0.0	119,091	274,816	—56.7	458,420	910,812	—49.7	1,386,972	1,069,101	29.8	1,658,661	497,696	233.0
Total Gross Revenue from Sale of Energy (Thousands of dollars)															
January	$12,180	$11,740	3.7	$49,100	$43,900	11.8	$41,300	$37,000	11.8	$9,780	$8,480	15.4	$14,610	$13,320	9.7
February	11,840	10,960	8.1	45,185	39,158	15.4	39,585	35,458	11.5	10,200	8,824	15.5	14,790	13,250	11.6
March	10,890	10,750	1.2	44,195	40,185	10.0	37,595	33,985	10.6	9,970	8,850	15.3	13,950	12,230	14.1
April	10,390	10,100	2.7	43,290	39,955	8.4	36,620	33,035	10.9	8,320	7,470	11.3	12,780	11,840	7.8
May	9,670	9,350	3.5	41,350	37,520	10.3	34,800	32,900	5.7	8,460	7,560	11.9	14,020	12,570	11.5
June	9,050	9,020	0.4	38,880	36,000	8.0	33,540	31,820	5.4	8,150	7,560	7.8	14,400	13,360	7.8
Total for 6 mos.	64,020	61,920	3.3	262,000	236,718	10.6	223,440	204,198	9.4	54,880	48,744	12.7	84,550	76,570	10.5
Total Operating and Maintenance Expenses (Thousands of dollars)															
January	$6,450	$6,635	—2.8	$20,800	$17,280	20.4	$20,680	$18,680	10.7	$4,430	$3,920	13.2	$5,310	$4,440	19.5
February	5,330	5,170	2.4	18,156	15,610	16.4	18,007	15,700	14.7	4,910	4,148	18.4	5,777	4,172	38.6
March	4,830	5,290	—8.7	18,538	16,729	10.7	18,597	16,698	11.4	4,675	4,455	4.8	6,110	4,228	44.3
April	4,510	4,575	—1.5	18,019	16,449	9.5	17,979	16,059	12.1	4,050	3,637	11.5	5,672	4,480	26.4
May	4,150	4,480	—7.5	17,933	15,971	12.3	17,484	17,081	2.5	4,350	3,900	11.5	5,583	4,318	29.5
June	4,160	4,955	—16.2	17,480	16,450	6.2	16,970	16,200	4.8	4,155	3,780	10.0	6,130	4,595	33.5
Total for 6 mos.	29,430	31,105	—5.6	110,926	98,489	12.6	109,717	100,418	9.2	26,570	23,840	11.4	34,582	26,233	31.7

* As reported by U. S. Geological Survey.

Energy Requirements 6.7 per Cent Over Last Year

CENTRAL-STATION operations during the first half of 1924, as reported monthly to the ELECTRICAL WORLD, showed a gradual decrease as the year developed. In the country as a whole the amount of energy generated declined from 10.0 per cent above 1923 operations in January to 1.3 per cent above 1923 operations in June. The amount of energy generated during the six-month period, 26,842,195,000 kw.-hr., was 6.7 per cent above that generated during the same period last year. If this same rate of increase is maintained during the last half of the year, the output of the industry for 1924 should total around fifty-five billion kilowatt-hours.

The gross revenue of the industry also decreased during the six-month period, but not to such an extent as the output. The revenue for the period totaled $688,890,000, an increase of 9.6 per cent over last year. The usual increase in the number of new customers during the remainder of the year should result in a total gross revenue for 1924 well over one billion four hundred million dollars.

The operating and maintenance expenses during June totaled $48,895,000, which was 6.4 per cent above June of last year. The operating ratio for systems having steam electric generating plants only was 52.1 per cent during June of this year, against 54.1 per cent for June 1923. The operating ratio during the six months period was consistently below the first six months of last year.

Turning to the operations of the industry in the various sections of the country, some very significant facts are disclosed. Despite the fact that in the industrial sections the estimated amount of energy consumed by industrial power customers steadily decreased as the year developed until in June the power energy consumption in the New England, Atlantic and North Central States was 19.9 per cent, 7.1 per cent and 8.5 per cent respectively below 1923 consumption, yet in no instance did any section of the country report a decrease in revenue under 1923. For instance, New England consumed 2.2 per cent less energy for all purposes during the six-month period than it did for the same period last year, yet the gross revenue was 3.3 per cent above last year. The South Central and Mountain Pacific States reported the largest percentage gains over 1923, and it was the growth of operations in these sections which saved the industry as a whole from reporting June operations under 1923.

TABLE IV—OPERATIONS OF CENTRAL STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES*

(100 per Cent of the Industry)

Mos.	Energy Generated		Fuel Consumption		
	Hydro Plants (Thousands of Kw.-Hr.)	Fuel Power Plants (Thousands of Kw.-Hr.)	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
1924					
March	1,705,060	2,890,892	3,781,084	1,496,604	3,099,404
April	1,822,448	2,528,672	2,470,245	1,186,779	2,731,201
May	1,915,001	2,497,081	2,405,151	1,161,270	2,908,367
June	1,730,796	2,889,388	2,316,371	1,264,211	3,623,144

* Data issued by U. S. Geological Survey.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS IN THE UNITED STATES DURING THE FIRST HALF OF 1923 AND 1924

(100 per Cent of the Industry)

Mos.	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
January	$126,970	$114,440	11.0	$57,670	$50,955	13.2	47.0	47.3	24.6	23.8	43.0	45.3
February	121,600	107,650	13.0	52,180	44,800	16.3	46.1	46.7	29.6	28.8	43.7	45.3
March	116,600	106,000	10.0	52,750	47,400	10.1	48.6	51.3	28.6	26.5	46.2	44.7
April	111,400	102,400	8.8	50,230	45,200	11.2	49.2	49.8	29.0	28.9	46.8	44.8
May	108,300	99,900	8.4	49,500	45,750	8.2	51.7	52.8	32.0	26.2	44.9	44.3
June	104,020	97,760	6.3	48,895	45,980	6.4	52.1	54.1	26.9	34.0	46.4	43.3
Total for 6 mos.	688,890	628,150	9.6	311,225	280,085	11.2	....	....	....	....	....	....

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include taxes, interest, depreciation or sinking fund.

TABLE III—GENERATION AND DISTRIBUTION OF CENTRAL STATION ENERGY IN THE UNITED STATES DURING THE FIRST HALF OF 1923 AND 1924

(100 per Cent of the Industry)

Mos.	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale Kw.-Hr.	
				Total Energy Consumption by Central Station Customers Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
Jan.	4,792,704	4,357,066	10.0	3,867,704	3,517,066	820,000	711,000	2,509,804	2,304,666	537,900	501,400	925,000	840,000	819,000	633,000
Feb.	4,470,153	3,966,278	12.6	3,608,903	3,200,278	733,000	635,500	2,371,873	2,108,398	504,030	456,380	861,250	766,000	752,300	581,500
Mar.	*4,595,952	4,331,204	6.1	3,708,952	3,493,704	788,000	683,000	2,383,152	2,309,214	538,300	501,490	887,000	837,500	782,220	616,000
April	*4,351,120	4,095,611	6.1	3,511,120	3,303,611	749,000	649,000	2,238,420	2,159,500	528,700	495,110	840,000	792,000	732,800	552,300
May	*4,412,082	4,265,190	3.4	3,560,582	3,442,690	757,000	655,500	2,257,482	2,274,700	545,600	512,490	851,500	822,500	732,500	602,000
June	*4,220,184	4,164,327	1.3	3,406,684	3,360,827	749,000	649,000	2,128,484	2,216,717	529,200	495,110	813,500	803,500	692,990	600,200
Total for 6 mos.	26,842,195	25,179,676	6.7	21,663,945	20,318,176	4,596,000	3,983,000	13,884,215	13,373,196	3,183,730	2,961,980	5,178,250	4,861,500	4,511,810	3,585,000

* Data on "energy generated" and fuel consumption is that collected and published by the U. S. Geological Survey for all public utilities, minus such data as is collected on energy generated by electric railway companies, reclamation service and manufacturing plants.

Regulator Settings for Long Lines—II

Automatic Voltage Regulator Can Be Used to Arrive at Desired Operating Characteristics—Theory of Performance, Example of Application and Analysis of Requirements

By L. F. WOODRUFF
Massachusetts Institute of Technology

THE general conditions of the problems associated with securing voltage regulation on long transmission lines were given in last week's issue of the ELECTRICAL WORLD. The problem is too complicated to admit of a comprehensive mathematical solution which will indicate explicitly the best method of regulation. Therefore, analytical investigations have to be confined to developing such methods of attack as will enable complete operating characteristics to be obtained for given adjustments of the regulating devices. A wide range of adjustments may be considered in detail, the operating characteristics of the system under each condition studied, and the set of adjustments which is found to be the best (i.e., which gives minimum annual cost) chosen for use. Circle diagrams and other graphical solutions have been found to be most useful in studying the operation in the steady state, but, a circle diagram for lines controlled by compounded regulators not being available, the scope of their usefulness was somewhat limited.

The Circle Diagrams of Power and Current for the Condition of Constant Voltage at Both Ends of the Line.—With a constant voltage at both ends of the equivalent II the locus of the load power (active versus reactive) is a circle (see Appendix 4). The co-ordinates of the center of this circle are:

$$P = -0.003\,V^2\,(RZ^{-2} + G_L) \text{ kw.,} \quad (1)$$

$$Q = 0.003\,V^2\,(XZ^{-2} - B_L) \text{ reactive kva.} \quad (2)$$

The radius of the circle is:

$$EVZ^{-1} \text{ kva.} \qquad r = 0.003\,EVZ^{-1} \text{ kva} \quad (3)$$

In the above equations V is the load-end voltage to neutral and E the generator-end voltage to neutral; R, X and Z are respectively the resistance, the reactance and the impedance of the architrave or horizontal bar of the equivalent II, and G_L and B_L are respectively the conductance and the susceptance of the load-end pillar of the equivalent II (see Appendix 5). The co-ordinates of the center of the current circle at the load are:

$$I_r = -V\,(RZ^{-2} + G_L) \text{ amp.} \quad (4)$$

$$I_i = \quad V\,(XZ^{-2} - B_L) \text{ amp.} \quad (5)$$

and the radius of the current circle is

$$r = EZ^{-1} \text{ amp.} \quad (6)$$

where I_r and I_i are respectively the active and the reactive components of current at the load. The locus of the current flowing in the architrave of the equivalent II is another circle of the same radius given in (6), but with its center located at

$$I_r = -VRZ^{-2} \text{ amp.} \quad (7)$$

$$I_i = \quad VXZ^{-2} \text{ amp.} \quad (8)$$

The only difference between the total load current and the architrave current is the current taken by the load-end pillar, which is constant. The vector relations of the various currents are shown in Fig. 3.

The Circle Diagrams of Power and Current for Constant Voltage at the Load End, the Generator Voltage Being Controlled by a Compounded Regulator.—With this method of control the current in the line at the generator end flows through a current transformer whose secondary is connected to a series winding on the main control magnet of the voltage regulator (see Fig. 2). This winding is connected so as to oppose the magnetomotive force of the shunt coil, and since the regulator, in order to function, must have in this magnet a definite flux, the amount of which is dependent on the regulator setting, it follows that the larger the line current becomes, the greater must be the voltage impressed across the potential coil to make the difference

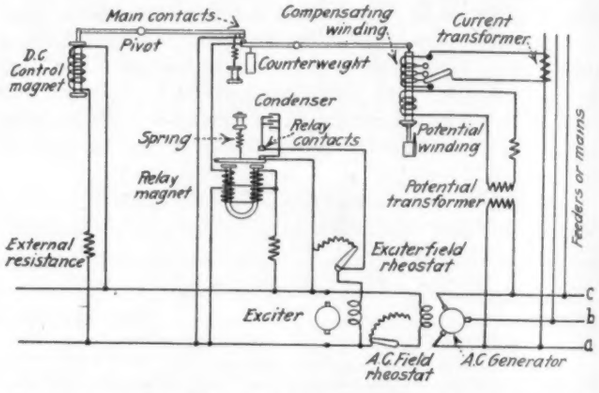


FIG. 2—ELEMENTARY CONNECTIONS OF THE TYPE TA TIRRILL REGULATOR OF THE GENERAL ELECTRIC COMPANY

of the two opposed magnetomotive forces equal to the required amount. In case the two magnetomotive forces are not exactly opposite in phase, it is their vector difference which must be considered, and so the power factor of the line current and the angle between the potential-coil current and voltage, as well as the value of the line current, will affect the magnitude of the rise in voltage. However, these additional factors, when taken into account in the analysis (Appendix 1) do not distort the previously described circle diagrams from their circular form, but merely change the radii of the circles and the co-ordinates of their centers. It will be seen later (Appendix 2), upon examining the results of a computation for a definite line, that by proper compounding the center of the circle may be located anywhere on the diagram.

The locus of the total load current, the active component (I_r) being plotted against the reactive component (I_i), is a circle the co-ordinates of whose center are:

$$I_r = -V[(RA + a)D^{-1} + G_L] \text{ amp.} \quad (9)$$

$$I_i = \quad V[(XA + b)D^{-1} - B_L] \text{ amp.} \quad (10)$$

and whose radius is

$$r = KD^{-0.5} \text{ amp.} \quad (11)$$

The notation used for the impedance and susceptance of the various parts of the circuit is given in Appendix

5. The meaning of the other new symbols used in equations (9), (10) and (11) is as follows:

$$a = G_G n_i^2 - G_p n_p n_i \quad \text{mhos} \times \text{turns}^2 \quad (12)$$

$$b = -B_G n_i^2 + B_p n_p n_i \quad \text{mhos} \times \text{turns}^2 \quad (13)$$

$$A = (a^2 + b^2) n_i^{-2} \quad \text{mhos}^2 \times \text{turns}^2 \quad (14)$$

$$D = Z^2 A + 2Ra + 2Xb + n_i^2 \quad \text{turns}^2 \quad (15)$$

K is a constant for any given setting and is equal to the number of net ampere-turns on the main control magnet of the generator voltage regulator for which the plunger will float. The value of K is adjusted by changing the counterweight. Wherever the word "equivalent" is used in the notation in describing some word, it is to be understood to change the term described in such a ratio that it may be used with actual line voltage and line current; that is, it is introduced merely as a convenient way of taking into account the effects of the instrument transformers connected between the line and the control magnet of the regulator.

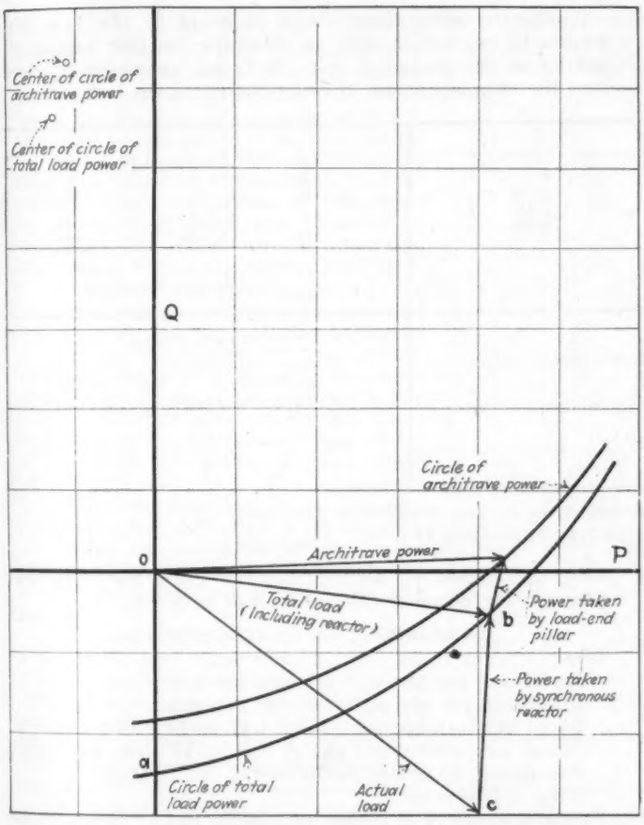


FIG. 3—VECTOR RELATIONS OF POWER OR CURRENT AT THE LOAD END OF A TRANSMISSION LINE ON WHICH CONSTANT VOLTAGE IS MAINTAINED AT BOTH ENDS

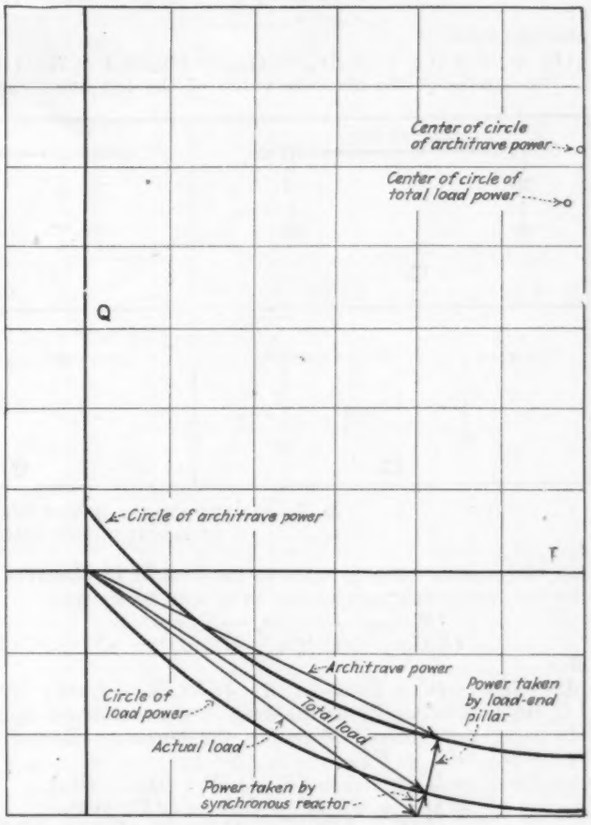


FIG. 4—VECTOR RELATIONS OF POWER OR CURRENT AT THE LOAD END OF A TRANSMISSION LINE ON WHICH THE GENERATOR-END VOLTAGE IS CONTROLLED BY A COMPOUND-WOUND REGULATOR

The locus of the architrave current, with the active component (I_r) plotted against the reactive component (I_i), is another circle of the same radius (equation 11). The co-ordinates of its center are:

$$I_r = -V(RA + a)D^{-1} \text{ amp.} \quad (16)$$

$$I_i = V(XA + b)D^{-1} \text{ amp.} \quad (17)$$

As in the simpler circle diagrams, the difference between the total load current and the architrave current is equal to the current taken by the load-end pillar, and since the load voltage is kept constant this pillar current is constant. The vector relations of current are shown in Fig. 4.

To compare the relative capacities of synchronous condensers that are needed to provide constant load voltage in the two cases of (1) constant generator voltage and (2) generator voltage regulator compound-wound, refer to Fig. 3 and Fig. 4. Assume that the load varies between zero and 80,000 kw. and that the power factor is 0.80 lag at all loads. If there is to be constant voltage at both ends of the line, the circle diagram will lie as shown in Fig. 3. The co-ordinates of the center are fixed by the load voltage and line constants, and the least capacity of synchronous condensers required is obtained by making the radius of the circle, which is adjusted by varying the generator voltage, as indicated in equation (3), such that the larger of the two distances *oa* and *bc* is a minimum; i.e., the maximum vertical distance betwen the line of load kva. and the circle of total load kva. (or current, if the current circle is used) should be a minimum, because it is this vertical distance which represents to scale the kva. output of the synchronous condensers. Actually, the distance should not be measured quite vertically, but along a direction which makes with the axis of active power an angle equal to the power-factor angle of the condenser. By scaling distances in Fig. 3, the capacity of synchronous condensers required is found to be 49,000 kva.

If the generator voltage regulator is compounded, the circle of total load current may be moved to the position shown in Fig. 4, and the size of synchronous condensers required drops to 7,500 kva.

It is not intended to imply that Fig. 4 shows the best location and size for the total load current circle. Owing to the other factors which enter, and which have already been enumerated, the best position is probably somewhere between the two positions shown in Fig. 3 and

Fig. 4 respectively. For the method of obtaining the best setting the numerical example of Appendix 2 should be consulted.

APPENDIX 1.—*Mathematical Derivation of the Equations of the Circle Diagrams for the General Case of a Compound Wound Voltage Regulator at the Generator End.*

The meaning of the notation used here may be obtained from Appendix 5; the axis of real numbers is taken coincident with the active component of load current and power —i.e., with the phase voltage to neutral at the load.

In order for the generator voltage regulator to function, the net ampere-turns on the main control magnet must be equal to some constant, say K, which is dependent on the regulator setting but independent of the load. In mathematical form, this is expressed as follows:

$$\text{absolute value of } [EY_p n_p - I_G n_i] = K, \quad (18)$$

or

$$\text{absolute value of } [(E_r + jE_i)(G_p + jB_p)n_p - (I_{Gr} + jI_{Gi})n_i] = K \quad (19)$$

The square of the absolute value of the left-hand member of equation (19) is equal to the sum of the squares of the real and imaginary terms, so it may be written:

$$(E_r G_p n_p - E_i B_p n_p - I_{Gr} n_i)^2 + (E_i G_p n_p + E_r B_p n_p - I_{Gi} n_i)^2 = K^2 \quad (20)$$

But

$$E_r + jE_i = (V + I_r'R - I_i'X) + j(I_r'X + I_i'R); \quad (21)$$

i.e., the load voltage plus the drop in the architrave equals the generator voltage. Moreover, the generator current is:

$$\begin{aligned} I_{Gr} + jI_{Gi} &= I' + EY_G \\ &= I_r' + jI_i' + (E_r + jE_i)(G_G + jB_G) \\ &= [I_r' + G_G(V + I_r'R - I_i'X) - B_G(I_r'X + I_i'R)] + j[I_i' + G_G(I_r'X + I_i'R) + B_G(V + I_r'R - I_i'X)]. \end{aligned} \quad (22)$$

Substituting (21) and (22) in (20), separating the real and imaginary terms, squaring and adding, and substituting the symbols a, b, A and D for their equivalents, as defined in Appendix 5, the following equation is obtained:

$$[I_r' + V(RA + a)D^{-1}]^2 + [I_i' - V(XA + b)D^{-1}]^2 = K^2D^{-1} \quad (23)$$

This is the equation of a circle with center co-ordinates given in equations (16) and (17) and the radius given by equation (11). It is the circle of architrave current.

The total load current differs from the architrave current only by the amount of the current in the load-end pillar, which is $V(G_L + jB_L)$. The equation for the total load current is therefore

$$\{I_r + V[(RA + a)D^{-1} + G_L]\}^2 + \{I_i - V[(XA + b)D^{-1} - B_L]\}^2 = K^2D^{-1}, \quad (24)$$

which agrees with equations (9), (10) and (11).

This solution contains, as the special case of $n_i = 0$, the solution for constant voltage at the two ends of the line. When $n_i = 0$, both a and b become zero; A becomes $Y_p^2 n_p^2$; D becomes $Z^2 Y_p^2 n_p^2$, and K becomes $EY_p n_p$; that is, the number of shunt ampere-turns on the main control coil at the generator end of the line. Making these substitutions in equations (9), (10) and (11), they become identical with equations (4), (5) and (6).

The equations, co-ordinates and radii of the circle diagrams for lines with compounded regulators are all given above in amperes. If it is desired to transform these current diagrams to power diagrams, the radii and the co-ordinates of the centers need only be multiplied by the factor $0.003V$. This gives the dimensions in total (all three phases) kilowatts and kilovolt-amperes at the load.

It is an easy matter to present the information contained in the above equations by means of an alignment chart instead of by circle diagrams, since any relations that can be expressed by curves can be expressed also by alignment charts. However, alignment charts, while in general somewhat easier to construct, are not so easy to use as families of curves.

APPENDIX 2.—*Numerical Example of the Application of the Generalized Circle Diagram to a Definite Line.*

Apply the generalized circle diagram to the line described below, with a view to obtaining the best regulator setting at the generator end. It is not necessary to give here the complete series of calculations for the best setting. Only the method of determining and using the circle diagram in the detailed calculation will be given.

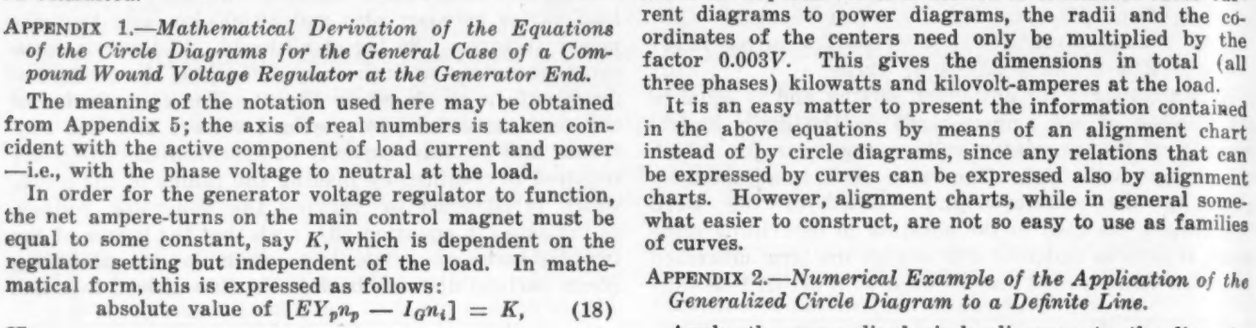


FIG. 5—VARIOUS STAGES OF THE TRANSFORMATION OF THE CIRCUIT OF LINE AND TERMINAL TRANSFORMERS TO ITS EQUIVALENT Π LINE

Constants of the Transmission Line

Line:
Resistance per phase, 0.127 ohm per mile.
Reactance per phase, 0.800 ohm per mile.
Shunt conductance per phase, 1.47×10^{-8} mho per mile.
Shunt susceptance per phase, 5.36×10^{-6} mho per mile.
Frequency, 60 cycles per second.
Length, 250 miles.

Transformers: Y-Y connected. Ratio 18 to 1 at both ends.

Load End:
Equivalent impedance referred to high-tension side, $1.50 + j36.0$ ohms.
Excitation, 2,600 kva. total at 200 kv. (three phases).
Core loss, 480 kw. (three phases).
Rating, 100,000 kva. (three phases).

Generator End:
Equivalent impedance referred to high-tension side. $1.44 + j34.7$ ohms.
Excitation, 2,700 kva. total at 230 kv.
Core loss, 490 kw.

Conditions of Operation:

A potential of 11,000 volts is to be maintained between lines on the secondary side of the load-end transformers by means of a synchronous condenser controlled by a shunt-wound voltage regulator. The regulator at the generator end is a General Electric Company type TA Tirrill regulator having 612 turns on the shunt winding of the main control magnet.

Calculations:

The transformers are replaced by their equivalent circuits, everything being referred to the high-tension side (Fig. 5a). The smooth line is then replaced by its equivalent Π (Fig. 5b). By a series of Δ-Y transformations the circuit passes through the successive stages of Fig. 5c and Fig. 5d to the single T or Y of Fig. 5e, which by a Y-delta

transformation becomes the equivalent Π of Fig. 5f. The constants of the final Π are:

$Z = 29.87 + j251.8$ ohms.

$Y_G = 3.785 \times 10^{-5} + j6.522 \times 10^{-4}$ mho.

$Y_L = 1.778 \times 10^{-5} + j6.347 \times 10^{-4}$ mho.

(Note: The number of transformations could have been decreased by one by using the equivalent T of the smooth line, instead of the equivalent Π, at the beginning.)

No generality will be lost by fixing at once the value of Y_p, the equivalent admittance of the generator-end potential coil. Let it be 1.506×10^{-5} mho, this being the value which allows normal current of 2 amp. to flow when the line voltage at the generator is 230 kv. The coil is supposed to be connected between line and neutral. Later the effect of connecting it between two lines will be shown.

The co-ordinates of the center of the circle diagram are not affected by a change in K, so the region in which the center of the circle can be located may be mapped out in terms of two variables, (1) the equivalent number of series turns on the control magnet, and (2) the angle of the potential coil impedance $= \tan^{-1}(B_p/G_p)$. Different values of these two variables are assumed, and the corresponding co-ordinates of the center of the circle diagram are obtained by substitution in equations (9) and (10). The results are shown plotted in Fig. 6. It is evident from this figure that by using the proper constants the center of the circle of load current may be moved to any position desired. The adjustment which would require minimum capacity of synchronous condenser at the load to maintain constant voltage there is readily found by locating the center of the circle which best fits the graph of actual load current. The adjustment for minimum copper loss in the line may be determined very closely by locating the center of the circle of architrave current which lies most nearly along the axis of active current over the working range.

An exhaustive study should now be made of the best circle of current to use with the prevailing load curve. This is done by a trial-and-error method; i.e., complete cost data as outlined above should be worked out for a considerable number of reasonable settings, and the setting which affords the most economical over-all operation should be chosen. A considerable amount of detail computation is involved in this, which cannot be given here. It will be assumed in this example that this study leads to the conclusion that the center of the load current circle should be located at

$$I_r = 300 \text{ amp.},$$
$$I_i = 400 \text{ amp.},$$

and that the radius should be

$$r = 500 \text{ amp.}$$

From Fig. 6 it is seen that in order to have these co-ordinates for the center the condition is that $n_i = 1.54$ turns and $\theta = -24$ deg. (i.e., the current in the potential coil circuit lags behind the voltage by 24 deg.).

It will be assumed that the current transformer and the potential transformer at the generator end are on the low-tension side of the transformer bank there and that they have ratios of 900 to 1 and 100 to 1 respectively. The current in the secondary of the current transformer will be one-fiftieth of that at the generator end of the equivalent Π, which was referred to the high-tension side. Therefore the actual number of turns in the series winding of the regulator should be $1.54 \times 50 = 77$ turns.

Since $\theta = -24$ deg. referred to the line in which the current coil is connected and the neutral, the 100-to-1 potential transformer can be connected between this line (phase a in Fig. 2) and line c and have the phase angle of the potential-coil circuit equal to 54 deg. lag; or else it may be connected between a and b and have the angle 6 deg. lead. In the type of regulator assumed above the resistance of the potential coil is 2.56 ohms and its reactance at 60 cycles per second is 4.40 ohms. External impedance should be added to make the total 55 ohms. It has been customary to use only resistance for this purpose, but it has been shown that complete control of the adjustments will require a reactance as well. For the total impedance to be 55 ohms and the phase angle 54 deg. lag, we have $R = 55 \cos 54$ deg. $= 32.33$ ohms; $X_L = 55 \sin 54$ deg. $= 44.50$ ohms. Therefore an external resistance of 32.33 $- 2.56 = 29.77$ ohms and an inductive reactance of 44.50

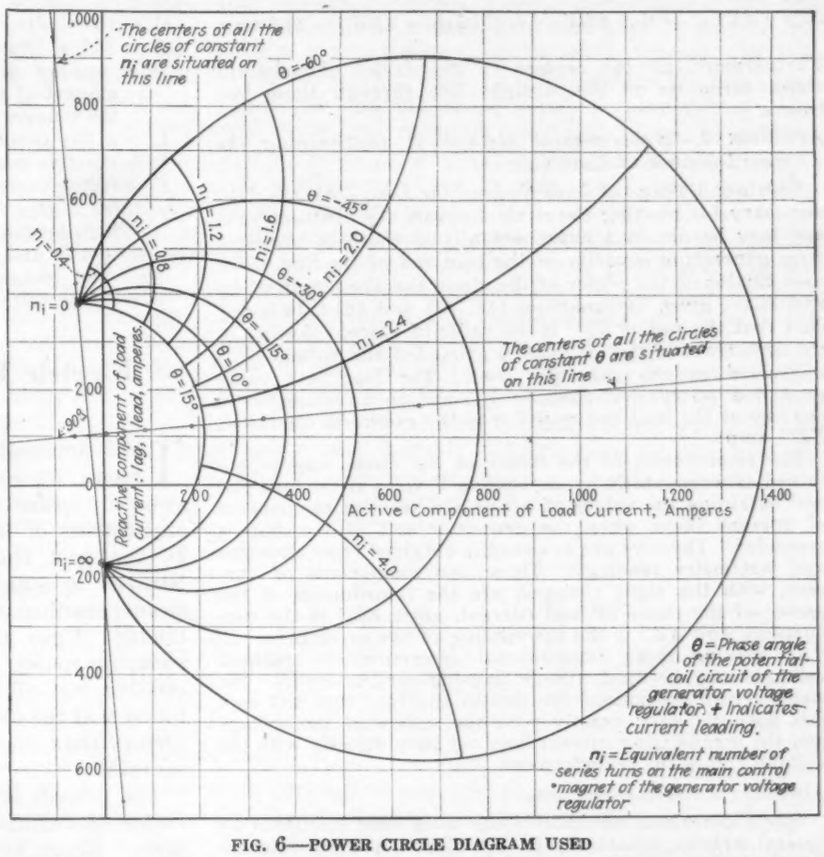


FIG. 6—POWER CIRCLE DIAGRAM USED

This diagram has as co-ordinates the two components, active and reactive, of the total current taken by the load. It is mapped out by means of two sets of curves—(1) curves of constant number of series turns on the generator voltage regulator, and (2) curves of constant phase angle of the potential-coil circuit of this regulator. The center of the circle diagram of total load current may be located at any desired point by first locating the point, by making use of the current co-ordinates, and then adjusting θ and n_i to be equal to their values as read from the power circle diagram at this point.

$- 4.40 = 40.10$ ohms should be connected in series with the potential coil across the terminals of the 100-to-1 potential transformer whose primary is connected to phases c and a.

The value of D for this setting, found by substituting in formula (15), is 4.098 turns². The radius of the circle is to be 500 amp. Therefore, from equation (11), radius $= 500 = K/\sqrt{D} = K/\sqrt{4.098}$. Hence, $K = 1{,}012$ ampere-turns. To adjust for this value of K, the current transformer should be short-circuited and the series winding of the regulator opened temporarily. By 1,012 ampere-turns it is indicated that a current of $1{,}012/612 = 1.653$ amp. in the potential coil will float the plunger of the regulator. This requires $1.653 \times 55 = 90.8$ volts across the coil, or 9,080 volts across the generator terminals. The counterweight of the regulator is adjusted until this voltage is maintained with the series turns removed.

The effect of the compounding in causing an increase in generator voltage with load may be obtained graphically as follows: Choose a voltage scale such that the distance from the point $n_i = 0$ to the origin in Fig. 6 is the voltage at the generator required to maintain the desired load voltage at no load. Then for any load the distance from

the point $n_i = 0$ to the point on the load-circle diagram representing that load is the generator voltage to the same scale.

The numerical work of making the computations for plotting the chart shown in Fig. 6 can be considerably reduced by making use of the fact that all the curves shown are circles and that all the circles of constant-phase angle of the potential coil go through two points. The co-ordinates of the upper point, at which $n_i = 0$, are given by equations (4) and (5). The co-ordinates of the lower point, at which $n_i = \infty$, are given by the following equations:

$$I_r = -V(RY_G^2 + G_G)\ (Z^2Y_G^2 + 2RG_G - 2XB_G + 1)^{-1} \text{ amp.} \quad (25)$$

$$I_i = V(XY_G^2 - B_G)\ (Z^2Y_G^2 + 2RG_G - 2XB_G + 1)^{-1} \text{ amp.} \quad (26)$$

Furthermore, all the centers of the circles of constant-series turns lie on the straight line through these two points.

APPENDIX 3.—*Experimental Method of Determining the Circle Diagram of Load Current.*

Constant Voltage at Both Ends of the Line.—All the data necessary for plotting the circle diagram for constant voltage may be obtained experimentally if there is available some generating capacity at the load end of the line. The co-ordinates of the center of the circle and the length of its radius are given by equations (4), (5) and (6). It is evident that the radius EZ^{-1} is the value of current flowing in the architrave if the load end is grounded and voltage E is impressed at the generator end. The load end being grounded, no current flows in Y_L, and so an ammeter in the line at the load end would read the radius of the circle, EZ^{-1} amp.

The co-ordinates of the center of the circle may be obtained experimentally by impressing V volts at the load end and obtaining the values of active and reactive components of current there when the generator end of the line is grounded. These values are readily obtained from ammeter and wattmeter readings. These two components of current, with the signs changed, are the co-ordinates of the center of the circle of load current, since RZ^{-2} is the conductance and XZ^{-2} is the susceptance of the architrave.

In making these experimental determinations reduced voltages may be used without causing serious error. The small errors introduced are due to the fact that the core loss does not vary exactly with the square of the voltage and the magnetizing current does not vary directly with the voltage across the transformers.

APPENDIX 4.—*Historical Note.*

Circle diagrams for short lines have been discussed by several writers, notably by R. A. Philip[4]. A circle diagram for a long line was developed by H. B. Dwight[5]. This circle was a plot between active and reactive power at the load for the conditions of constant voltage at the two ends of the lines. The effect of transformers on the diagram was treated by Evans and Sels[6], the present author[7], Dwight[8] and Holladay[9]. Abroad the graphical method of solution had been advanced even further by Thielemans[10]. He developed graphical solutions for short lines whose generator-end voltages were controlled by line-drop compensators. Thielemans presented many other graphical constructions in addition to this. Circle diagrams for a 90-mile and a 380-mile line are described by McKinstry[11].

APPENDIX 5.—*Notation.*

V = voltage to neutral at load end of line, referred to high-tension side.

E = voltage to neutral at generator, referred to high-tension side.

$z = R + jX$ = vector impedance of architrave of equivalent II.

Z = scalar impedance of architrave of equivalent II.

$Y_L = G_L + jB_L$ = vector admittance of load-end pillar of equivalent II.

$Y_G = G_G + jB_G$ = vector admittance of generator-end pillar of equivalent II.

n_p = number of turns on potential coil of generator-end regulator main-control magnet.

n_i = equivalent number of series turns on generator-end regulator main-control magnet.

$Y_p = G_p + jB_p$ = equivalent admittance of potential-coil circuit of generator-end voltage regulator.

θ = equivalent phase angle of potential-coil circuit of generator-end voltage regulator.

$a = G_G n_i^2 - G_p n_p n_i$.

$b = -B_G n_i^2 + B_p n_p n_i$.

$A = (a^2 + b^2) n_i^{-2}$.

$D = Z^2A + 2Ra + 2Xb + n_i^2$.

K = number of net ampere-turns on the main-control magnet of the generator voltage regulator for which the plunger will float.

I_r = active component of current.

I_i = reactive component of current.

I' = vector current in the architrave. (Appendix 1.)

$I_G = I_{Gr} + jI_{Gi}$ = vector current of generator, referred to high-tension side.

Subscripts r and i always denote active and reactive, or real and imaginary components, respectively, either of current or voltage.

[4] *Trans. A. I. E. E.*, 1911, Vol. XXX, p. 597.
[5] "Constant Voltage Transmission" (1915).
[6] *Electric Journal*, July, August and December, 1921, and *Journal A. I. E. E.*, January, 1924.
[7] Solution distributed to graduate students in electrical engineering, Massachusetts Institute of Technology, in December, 1921.
[8] *Trans. A. I. E. E.*, 1922, Vol. XLI, p. 781.
[9] *Trans. A. I. E. E.*, 1922, Vol. XLI, p. 785.
[10] *Revue Générale de l'Electricité*, 1920, pp. 403, 435, 475, 515; 1921, pp. 451, 599, 675, 878, 929.
[11] *Trans. British I. E. E.*, 1921.

Electric Heat Applied to Sweating of Citrus Fruits

THE application of electric heat in the sweating rooms where lemons, oranges and grapefruit are sweated before shipment is one of the most recent applications of industrial electric heating in the West. In the past this process was carried out with oil burners to supply the necessary heat, but when a cleaner method was sought engineers turned to electricity. Upon the installation of electric heaters in sweating rooms, tests were conducted to determine the relative cost of the new method. As a result it was found that the electric heaters were not only more satisfactory than the oil burners but were less expensive to operate.

The process of sweating fruit usually takes place in rooms approximately 25 ft. long, 15 ft. wide and 10 ft. high. Where kerosene was used in the operation the burners were partially smothered to generate the necessary amount of ethylene gas for properly sweating the fruit. With the installation of electric heaters the gas is supplied in tanks, and the heat is turned on only long enough to keep the temperature of the rooms up to between 75 deg. and 85 deg. F., which is the temperature required for the best results from the process. The fruit is left in the sweating room from three to five days, during which time the ethylene gas and the heat cause increased respiration by opening up the pores of the fruit and so prepare it for shipment with less danger of spoilage.

An installation of several heating systems in the sweating rooms of the Wittier Select Fruit Growers' Association of California was made recently by the Westinghouse Electric & Manufacturing Company. Each sweating room was provided with a heating unit consisting of four standard space heaters, of the type shown in the accompanying illustration, mounted in a sheet-metal box. The current in the heaters can be controlled either automatically or manually, so that the heat is turned on only at the time when it is needed. Such control is an important factor in the economy of the new method of heating the sweat rooms.

Electrifying Ten-Inch Merchant Mill

Electric Drive Replaces Engine Drive to Produce Cutlery Steel Without Marking and Without Reheating— Details of Installation and Control

By M. J. WOHLGEMUTH* and M. H. MORGAN, Jr.†

THE principal products of the McKeesport (Pa.) works of the Firth-Sterling Steel Company are special alloy steels for the manufacture of cultery and tools, including finished material ranging from 0.037 in. double-bevel stainless steel for knife blades and ⅝-in. rod for drill stock up to 8-in. hand rounds. There are in this plant, besides the new 10-in. mill which is the subject of this article, three other merchant mills. One, a 12-in. five-stand mill, driven by a 750-hp. non-condensing engine, rolls flats and squares and rounds as large as 8 in.; another, an 8-in. mill, driven by a 650-hp. non-condensing engine, rolls small rounds, flats and squares and such shapes as this plant produces. The third is a 10-in. mill, also engine-driven, producing ribbed wire and rod for drills. All mills are in one building and within 600 ft. of each other and of the steam-boiler plant.

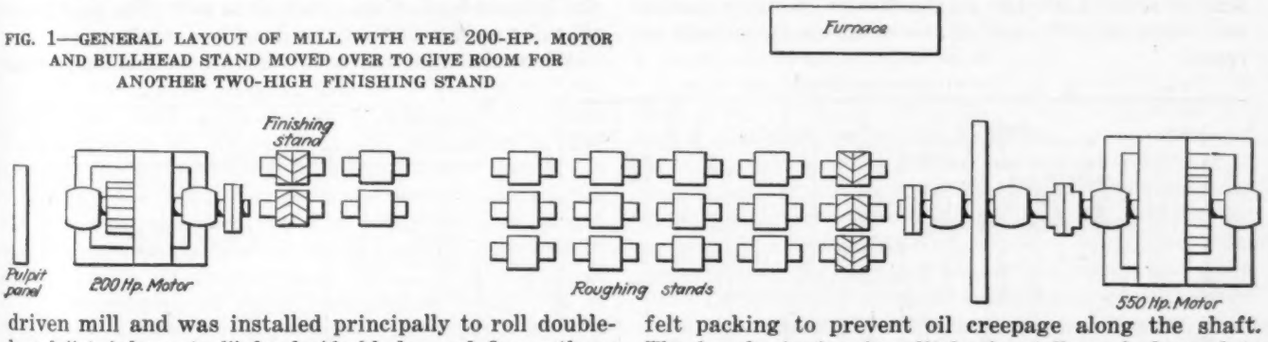
The new 10-in. merchant mill replaces an old engine-driven mill and was installed principally to roll double-bevel "stainless steel" for knife blades and fine cutlery. This product receives two finishing passes and is then of very small section, so that it cools rapidly. Finishing it without marking and without reheating therefore requires a higher speed than in the roughing passes, and separate motor drive is used to avoid the whip action and backlash which would result if this stand were driven through the other four.

The mill was built by the United Engineering & Foundry Company and consists of four three-high roughing stands driven by a 550-hp., 50-deg.-rise, 250-volt direct-current variable-speed Westinghouse motor running at 120 r.p.m. to 300 r.p.m., with a 22,000-lb. cast-steel flywheel, and one bullhead stand driven by a 200-hp., 50 deg.-rise, 250-volt, 200-r.p.m. to 500-r.p.m. direct-current motor.

The 550-hp. motor and flywheel are coupled to the middle roll through a flexible coupling, and mill pinions drive the top and bottom rolls. The flywheel is 11 ft. 6 in. in diameter and has a flywheel effect of 12,000 hp.-seconds at its maximum speed. The 200-hp. motor which drives the bottom roll of the finishing stand has a light thrust bearing to take ordinary thrust that might result from an accident to the mill. It is set in a shallow pit to bring the motor shaft in line with the bottom roll and so arranged that it may be slid over a short distance, and when so moved will leave room for another stand of rolls between the last roughing stand and the stand which it now drives. This will allow the range of the mill to be extended to include products which it cannot handle with the present arrangement, yet it adds very little to the cost of the installation.

The 550-hp. motor driving the four-stand roughing train (Fig. 3) is a standard open self-ventilating compound-wound-mill-type motor. The cast-steel frame is split horizontally and provided with eye bolts in the top half to permit easy removal for inspection and repair of the field poles or coils and armatures. The rotor is carried on low-type pedestals in babbitted sleeve bearings having oil-ring lubrication and provided with overflow and dust-proof filling cap, oil throwers and felt packing to prevent oil creepage along the shaft. The brush rigging is split horizontally and clamped to the frame and, since the machine has commutating poles, does not require adjustment after the initial setting at the factory.

FIG. 1—GENERAL LAYOUT OF MILL WITH THE 200-HP. MOTOR AND BULLHEAD STAND MOVED OVER TO GIVE ROOM FOR ANOTHER TWO-HIGH FINISHING STAND



An overspeed device is mounted on the shaft at the commutator end of the machine. When the motor speed reaches a certain value for which the device is set the centrifugal force of a rotating weighted arm forces it outward against the restraining action of a spring; the arm strikes and trips a fixed contact, and the opening of this contact breaks the holding circuit of the low-voltage relay on the control panel, which disconnects the armature and starts the dynamic braking operation.

The motor is coupled through a Thomas mill-type flexible coupling to the flywheel, which is mounted independently on its own bearings. These bearings are also sleeve-type, babbitted and split, with oil-ring lubrication. There is a shoulder or collar on the shaft between the mill coupling and the flywheel which is set to just clear a similar collar with a babbitted face, supported by the flywheel-bearing pedestal, so that a thrust from the mill will bring the two faces together and be absorbed by the pedestal. The whole is inclosed against mill dust and lubricated by an oil drip cup.

The machine is compounded to give about 15 per cent speed regulation so that it may drop in speed suffi-

*Switchboard engineer Westinghouse Electric & Manufacturing Company.

†General engineer Westinghouse Electric & Manufacturing Company.

ciently under peak loads to make available the rotating energy of the flywheel. The wheel has a flywheel effect of 22,000 hp.-seconds at 300 r.p.m., and with a drop in speed of 15 per cent it gives up $(1 - 0.85^2) \times 12{,}000 = 3{,}300$ hp.-seconds. There is a knife switch on the motor frame which when closed shunts a portion of the motor series field, so that at the higher speeds when the shunt field is weak the change of speed with load will not be too great.

The flywheel on this mill permits the use of a much smaller motor than would otherwise be required and also reduces the duty on the motor-generator set which supplies its power. Since there are four stands in this train and for some schedules as many as fourteen passes, there are often four or five pieces in the mill at one time. One schedule which was to be rolled showed a possibility of peaks of 1,200 hp. due to there being five pieces in the mill at one time, but since the large reductions are made on the early and very short passes these peaks were only of one or two seconds' duration. The motor has a guaranteed momentary overload capacity of 100 per cent and would probably take care of these peaks, but since a piece was to be entered in the mill every twenty seconds there would be several such peaks in one duty cycle and their result would be to increase the r.m.s. or equivalent heating horsepower to a value greater than 550. In addition to this effect, such peaks coming in conjunction with full load on the 200-hp. finishing-stand motor would mean a load of about 1,200 kw. on the 500-kw. motor-generator set, when the efficiency of the motor is taken into account.

When a flywheel of adequate size is applied in conjunction with a motor having proper compounding, the drive will slow down under such peaks and the motor will supply only a part of the load while the flywheel supplies the remainder. During the intervals between peaks when the load is well below the motor rating the drive speeds up while the motor returns to the flywheel the energy given out on the previous peak. Thus the load on the motor is kept much more constant, and, while there is a certain friction and windage loss which is due to the flywheel, the saving in motor and generator size and in wear and tear more than compensates for this.

The 200-hp. motor driving the single finishing stand (Fig. 5) is of the same type and general construction as the 550-hp. motor already described. It is coupled directly to the bottom roll, and the bearing pedestal nearest the mill carries a thrust bearing similar to the one on the bearing of the roughing-train flywheel. By the time the piece reaches the finishing stand it has had its cross-section reduced to about one-tenth of its original area and its length increased in the same proportion. The delivery speed of this stand is higher, of course, than that of the roughing stand; but even considering this fact the duration of the finishing pass is much greater than that of the roughing passes. This means that a flywheel would have given up all its rotating energy at the end of such a long pass so that the motor would be carrying the total useful load and the friction load of the flywheel as well. For this reason there is no flywheel on the finishing stand.

When the mill was first put into operation it some-

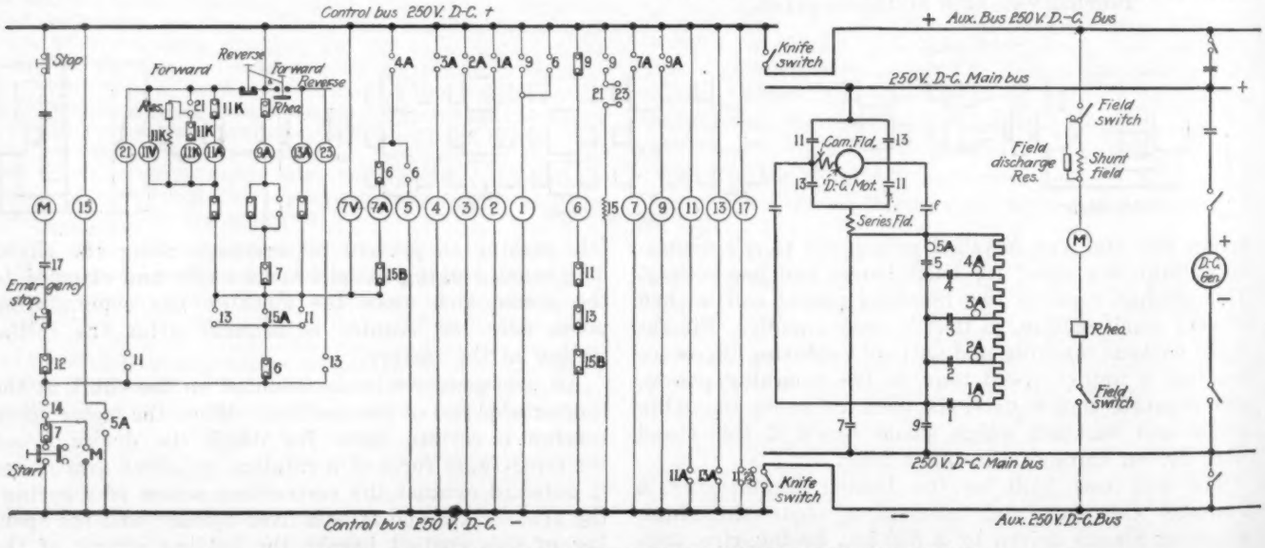


FIG. 2—SCHEMATIC DIAGRAM OF THE CONTROL FOR ONE-MILL MOTOR

The motor-generator set is started up in the usual manner and tied in to the direct-current bus. The red lamp on the pulpit panel will light, and the mill attendant then presses the set-up button for either forward or reverse operation, brings the field rheostat to the full field position and presses the start button. If full field is established on the motor 14 field, protective relay will be closed. This allows forward directional carbon circuit breaker 11 to be closed by energizing 11-A, its closing coil. No. 11 energizes relay 17, and this closes master relay *M*, which then holds itself in, bridging the start-button contacts. This sequence takes only a few seconds, and at this point the start button may be released. No. 11 also closes up relay 21 through interlocks, and this relay closes coil 11-*K* of the directional breaker, so that it may be opened by a loss of voltage which will drop out 11-*A*, the low-voltage coil. Relay 9-*A* has also been energized through the start-button contacts and it closes 9, which in turn closes 1 and puts the motor across the line with full starting resistance in series with the armature. The motor turns over slowly, and as it gains speed and the current falls to a predetermined value the series accelerating relay under 1 operates the closing coil of 2 contactor, short-circuiting a portion of the starting resistor. In similar fashion 3, 4 and 7 are closed in succession, and when 7 has been closed the motor is directly across the 250-volt line with all armature resistance out. Its speed may then be adjusted by manual operation. When 7 closes, an interlock opens 9, and it in turn opens 1, 2, 3 and 4.

If, while running, the shunt field should fail, the overspeed device should operate or the stop button be pressed, master relay *M* would drop out, opening 7, 11, 21 and 17. Dynamic braking contactor 6 closes, and an interlock closes 1, placing full starting resistance across the motor armature. The motor field is still energized and the machine begins to generate, forcing approximately full starting current through the resistor. As the motor decelerates and the braking current falls, the operation of the series relays closes contactors 2, 3 and 4 and finally 5, which short-circuits the motor armature on itself.

The series relay under 5 contactor is set to release only at a very low value of current to make sure that the motor is practically at standstill before any further operation can take place. When the series relay 5-*A* closes after the braking current has died down, it operates relay 15, which opens 6, and 6 in turn opens 5 and 1. After this the motor may be restarted as before with the same sequence of operations.

If for any reason it becomes necessary to reverse the mill while in operation, all that the operator needs to do is to press the reverse set-up button on the pulpit panel. This drops out the forward directional breaker 11, and contactors 7, and the dynamic braking sequence goes forward just as when the stop button is pressed. If the field rheostat is in the full field position, this will close up 9 and reverse directional contactors 13, and the motor accelerates to full speed in the reverse direction as before.

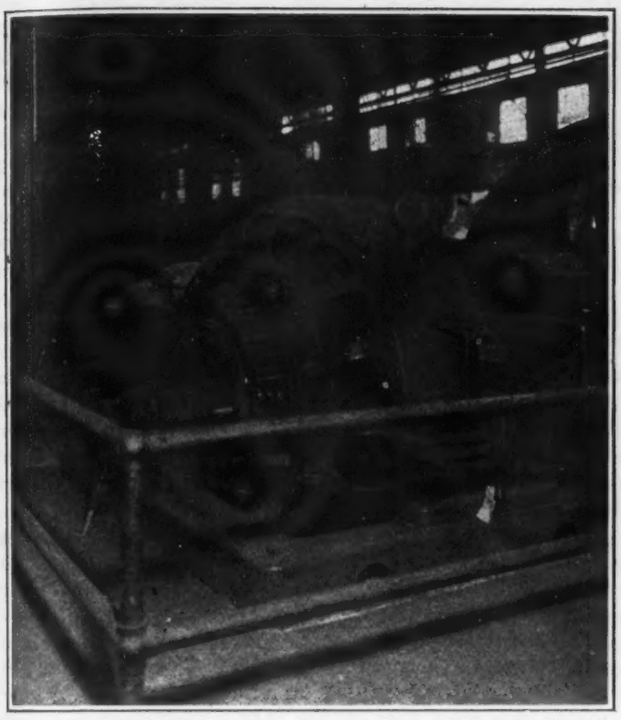


FIG. 3—THE 550-HP. MOTOR DRIVING THE FOUR-STAND ROUGHING TRAIN

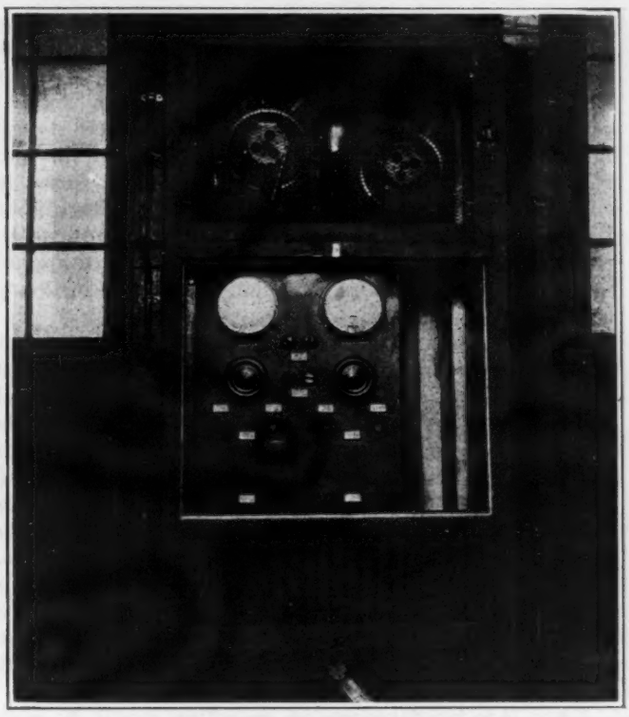


FIG. 4—OPERATOR CONTROLS MILL MOTORS BY MEANS OF THIS PULPIT PANEL

times happened that the piece was quite cold—in fact, had turned black by the time it reached the finishing stand—and this, of course, enormously increased the load on the 200-hp. motor. When this occurred the motor was called upon to carry 300 per cent rated load, and this it did without the slightest sign of distress or commutating difficulty, there being no discernible sparking even on these peaks. The motors were, of course, not expected to carry this load, but it is of interest to note what these mill-type motors will and can do in an emergency.

The substation of the steel company, consisting of two small direct-current engine-driven generators and two 150-kw. synchronous motor-generators, did not have sufficient capacity to supply the new mill drive in addition to the plant load of about 250 kw. for cranes, shears, reels, pumps and lights. A synchronous motor-generator of sufficient capacity to supply the mill motors independently was therefore purchased. The removal of one of the engine-driven generators allowed ample room for placing both the new motor-generator and the mill-motor-control panels in the substation, thus doubling its capacity without adding to the room. Fig. 6 shows an installed view of this set.

Power for the motor-generator is purchased from the local power company at 2,200 volts, three-phase, 60 cycles, and brought into the substation on an overhead line. The synchronous motor of the motor-generator is provided with a three-breaker starting equipment and auto-transformer. There is one large oil breaker for running, and two smaller oil breakers supply low voltage, starting through the auto-transformer, and then serve to disconnect the auto-transformer on both sides when the running breaker is closed and the set operating on full voltage. These breakers are mounted on the wall back of the switchboard, and the operating handles on the front of the switchboard control them through rods and bell cranks. The direct-current end of the set is tied into the bus by an automatic carbon breaker and knife switches. Excitation for the machine is obtained from a direct-current auxiliary bus which can be tied in to the two 150-kw. motor-generators

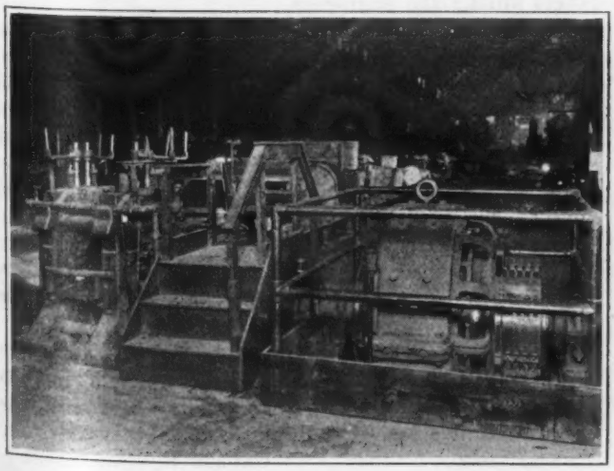


FIG. 5—THE 200-HP. MOTOR DRIVING THE FINISHING STAND

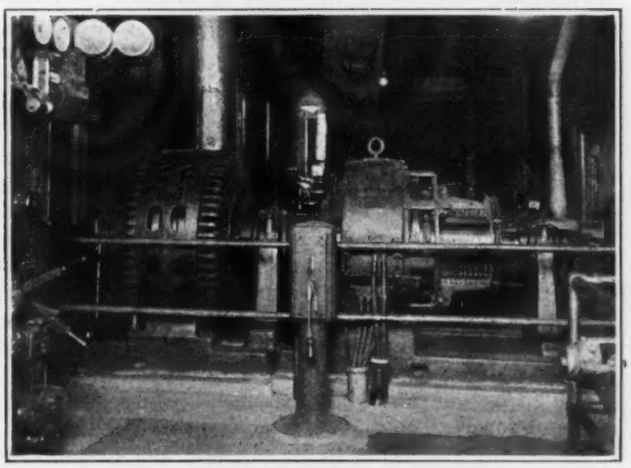


FIG. 6—THE SYNCHRONOUS-MOTOR-GENERATOR SET

or energized by the 500-kw. set. This auxiliary bus supplies the mill-lighting circuit and various small motor drives, such as cranes, reels and shears. A tie panel on the switchboard carrying a carbon breaker and knife switch makes it possible to disconnect this bus from the 500-kw. set and supply it from the two small sets, and when this has been done it is possible to adjust the voltage on the main set to give higher or lower speeds on the new mill than those for which the motors are rated. This allows the rolling of special material, but of course is not done for ordinary operation.

After the motor-generator has been started and put on the bus, control of the mill motors is completely in the hands of the operator from a small pulpit panel placed beside the mill. Fig. 4 is a front view of this panel showing its arrangement. Its location is shown in Fig. 1. The motor-field rheostats are mounted above this panel and operated through a sprocket and chain from a handle on the face of the panel. The panel also carries for each motor "start" and "stop" push-buttons, set-up buttons for forward or reverse operation and an ammeter calibrated to read horsepower output. There are also red and green indicating lamps to show the position of the alternating-current and direct-current breakers.

From this brief résumé of operation it will be seen that the control is simple and flexible and requires manipulation of two push-buttons and a field rheostat only, all of which are placed within easy reach of the mill operator. The equipment is amply protected in any contingency, the motor being disconnected from its source of power in case of overload, loss of field, loss of voltage or overspeed. The performance of the whole installation has proved to be very satisfactory.

Letters from Our Readers

Why Engineers Are Underpaid

To the Editors of the ELECTRICAL WORLD:

The remarks of B. P. Foster of Wilmington, Del., in your columns on August 9, are indeed interesting and timely. However, allow me to say that the only striking feature of his letter is the fact that it indicates an element of surprise on his part. Upon a somewhat closer examination I feel sure Mr. Foster will experience no difficulty whatsoever in obtaining abundant evidence that there is a preponderating number of engineers all over the country who are well advanced in years and ripe in experience and nevertheless lamentably underpaid for their work and the indispensable services they render.

There are two definite and well-known causes responsible for this condition. The first and most important is the fact that all engineering colleges have a wholehearted ambition to enlarge their little universe and boast as great an attendance as possible. They almost seem to be in a competitive race to put the development of engineers on a basis of quantity production. Even a mild sense of humor would impel one to think at times that they were attempting to rival the way Henry Ford turns out his cars, except, of course, that the demand for real engineers falls far short.

But there does seem to be a subtle and nation-wide propaganda aimed solely to produce engineering graduates in large numbers from the colleges.

In a personal talk I had with the late Dr. Charles P. Steinmetz in regard to these conditions my convictions in this matter were only strengthened.

The obvious and most harmless method of remedying this situation is for all colleges to manifest and enforce an unselfish spirit of co-operation in prescribing either much higher entrance requirements, far more thorough or more advanced studies, or, on the other hand, a five-year and if possible a six-year course in engineering. I have not the slightest desire to keep any ambitious young man from attending college, but I vehemently protest against the ever-growing tendency for him to commit economic suicide after graduation. A stiffening of the requirements would automatically check or regulate the attendance and thus be a blessing to the men who are out of college and also just as much to those attending.

Nowadays a great number of well-trained graduates —I will not yet call them engineers—are being utilized as skilled laborers or as technical clerks, under the expedient guise of "getting experience." Most of these fine young men have no money after leaving college and the relentless economic conditions force them to be drafted for such purpose. For most of the work falling under this classification the intellectual equipment and analytical powers of a high-school sophomore would be more than ample.

The second cause of the conditions to which Mr. Foster has called attention is the utter lack of social co-operation and organization among engineers. The present national engineering societies are very valuable as a clearing house of practical experiences and scientific discussions. They are extremely useful as far as the progress of the arts is concerned and contribute an enormous amount of good and constructive work which is of everlasting benefit to the entire world. Nevertheless, the marvelous application of science to industry, as it is, for example, now and then displayed by means of hyperbolic functions, complex quantities or rotating vectors, or other mathematical tools, holds only a very vague and remote place in the minds of the vast majority of engineers when they are confronted with the question of paying the rent, buying a pair of shoes or getting a new dress for the baby. In short, these well-known societies, outside of assisting in obtaining employment for their members, are largely absorbed with the advancement of their sciences and technique rather than in furthering and promoting human happiness among the engineers.

The engineers should to a certain extent lay aside their "professional dignity"—which in many cases is, psychologically speaking, nothing but naïve vanity—and form some sort of a protective organization. Even the reasoning of a bricklayer has accomplished that much for himself. Organization does not necessarily mean economic abuse of the power thus gained. So long as the engineers lack the courage to undertake such a step or are bamboozled into not taking it, they will be at the mercy of our industrial octopus, and this will remain so notwithstanding any open or subtle propaganda by "authorities" to the contrary.

I also wish to thank Mr. Foster for his courage in expressing his views—and the editors for allowing him to do so. Most engineers lack even the courage to express the convictions that I know too well they entertain.

Boston, Mass. GEORGE F. MARSTELLER.

Central Station and Industrial Practice

Test for Endurance of Two Air-Break Switches

TWO different makes of air-break switches (one of them being the Pacific Electric type No. 1427) have been tested by one electric light and power company for mechanical endurance by mounting them as they would be mounted on the cross-arm of a pole and opening and closing the switches at the rate of twenty-six times per minute. The opening of the switches was done by means of an arm and cam arrangement driven by an electric motor and closed by means of weights and pulleys.

Except for breakage of some of the copper ribbons connecting the lines with the switch blades, the Pacific-type switch operated for one hour and forty-one minutes, or about 2,600 times, without any damage. However, the other switch, which will not be named, failed to operate at the end of forty-four minutes, or after 1,144 operations, owing to a pin dropping out of the middle switch pole. Other pins were observed to loosen, and one of the switch blades would not close completely.

As a result of these tests, it was concluded that the Pacific-type switch is more simple to operate and would be the better switch if a more flexible connection were made from the switch blade to the line insulator. The other switch is considered more complicated and more likely to get out of alignment.

As a result of these tests the manufacturer of the second switch reported that the loosening of the pins was due to their poor fit and that instructions had been given to the factory to exercise more care in assembling them hereafter. The alignment of the blades can be assured, it was reported, by proper fitting of the hinge joint, and this fact also is being called to the factory's attention. Furthermore, to prevent the shearing of the pin in the crank underneath the switch it was decided to enlarge the pin.

The Pacific Electric Manufacturing Company's switch, which withstood the test best, was modified after the test by providing it with copper braid instead of copper ribbon. In this condition the switch was operated two thousand times without any failure whatever. The flexible conductors are the same as those used on the Pacific-type No. 5219 switch. This change will be incorporated in all new switches of this make. In addition, the Pacific Electric Manufacturing Company has agreed to make a change in the switch which will preclude all possibility of the control lever pin breaking and allowing the switch to be jarred closed.

Other features which have influenced this electric light and power company to standardize on this particular switch are the fact that two men can install one in one-half day compared with one and one-half days for the other type of switch tested, thereby saving about $15 in labor. In addition, the Pacific type of switch will cost only about 64 per cent as much as the other make considered. The switch is rated at 27,000 volts, 300 amp., and is a three-pole, air-break, disconnecting switch.

Testing Distribution Line Tools for Safety

BY T. B. BASH
Superintendent Overhead Construction
Kansas City (Mo.) Power & Light Company

TO AVOID accidents when working on high-tension lines the Kansas City Power & Light Company makes periodic tests of all the line tools, including rubber goods and pike poles. Three complete sets of line tools are used. One set is in the laboratory in A-1 condition so that work on the lines will not be tied up through faulty tools. Each article submitted for test is recorded on a blank shown herewith, certifying the conditions of tests and the results found. Any necessary re-

CERTIFICATE OF TEST

ENGINEERING DEPARTMENT—RESEARCH LABORATORY

KANSAS CITY, MO.

3-27-24 192

Submitted by Overhead Const. Dept. (Giltner, Truck #17)

Address 1330 Grand

Charge Account 99

Apparatus and Conditions of Test on Rubber Goods. Temp. 23° C. Checked on 60 cy.

Plant #	Factory	Make	Commodity	OK @ Volts	B.D.V.	Condition	
623	-----	U.S.	Blanket	----	6000	B.O.	0 min.
618	-----	"	"	7500	---	"	3 min.
619	-----	"	"	"	---	O.K.	"
626	-----	"	"	"	---	"	"
43	M702	Diamond	Shield	11000	----	B.O.(Cut)	1 min.
53	M136	"	"	"	----	O.K.	"
60	0600	"	"	"	---	"	"

5 gloves mechanically and electrically B.O. when received.

13 gloves tested O.K. at 7500 volts for 1 min.

Results

KANSAS CITY POWER & LIGHT COMPANY

By Giltner F. Meredith

CERTIFICATE OF TEST USED ON LINE TOOLS SHOWING RESULTS OF MECHANICAL AND ELECTRICAL TESTS

finishing is done in the laboratory and a description of the work is recorded on this certificate.

The type of test these tools have to withstand is that if a pole is too "fuzzy" at 60,000 volts it is then put in a drier installed in the laboratory, where it is dried and treated until it stands a satisfactory test at the required voltage. The cord hand line used in tieing out phase wires is also tested and treated with a paraffin composition. In addition to these tests all the line tools are painted with a red band, beyond which a lineman should not hold the stick, thus avoiding the danger zone at 66,000 volts. This was added as an additional precaution of safety. A special line truck is equipped for this class of work, which is provided with weatherproof bags to carry all the tools so as to keep them in dry condition at all times. This periodic testing of line tools has been largely responsible for the tool gang's two and a half year operating record without serious accidents.

Modernizing the Small Plant

Remodeling 2,300-Kva. Plant to Conform with Modern Practice—Obsolete Equipment Replaced and Untrained Operating Force Educated

BY M. D. LESLIE
Electric Service Company, Dodge City, Kan.

SUPERPOWER stations have come to the front very rapidly in the last few years, and electrical literature is filled with descriptive articles of their wonderful and complicated machinery and layouts and of their remarkable performance records. In view of this the operator of a small station is apt to become discouraged, especially when he considers his limitations and the frequent reference to the passing of the small central station.

If the small station be within the range of one of the major stations, the outlook is even more discouraging, because it should be remembered that, in a manner, the electric plants in isolated communities must actually compete with the major stations, not because of their proximity, but because the widespread information concerning rates and the operating costs of household appliances causes the public to demand rates which are comparable with those of the major stations, regardless of the disparity in the possible operating costs.

Although it is impossible for the small station to obtain the same thermal efficiency as the major stations, it is possible for them to operate at the same relative efficiency, which will enable them by reason of smaller overhead expenses to make a presentable showing. Of course, it is essential that there be good equipment and that it be well operated.

In the western part of Kansas, 150 miles from any large city, there is an electric service company situated in a small community whose success illustrates what can be done with a relatively small system. The plant is situated in a town of about 6,500 population, and the total population which can be served is about 11,000. This involves the operation of 175 miles of transmission lines. The construction and operation of such an extensive network to serve so few people would seem impossible to the average executive in more populous communities, but it can be done successfully and economically.

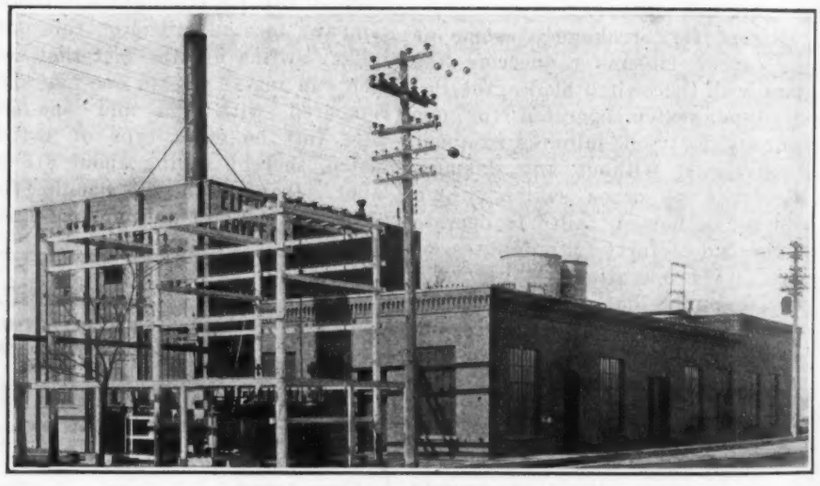
For many years the plant was hampered by limited business, rising costs and inadequate and inefficient machinery. The old equipment was finally replaced with new and modern machinery. The boiler room contains 859 hp. in 200-lb. pressure boilers, equipped for 100 deg. superheat and fed with coal by underfeed stokers. There is also the necessary coal and ash handling equipment and other appurtenances. The generating equipment consists of three condensing turbo-generator units totaling 2,300 kva. The water rate of the turbines at 200 lb. pressure, 100 deg. superheat and 28 in. of vacuum was to be 18 lb. of water per kilowatt-hour at full load, and an efficiency of 72 per cent was expected from the boilers and stokers.

All this was a big change for a company of this size and might seem impossible, but it was not done all at one time, nor is it necessary that such reconstruction should be. The essential thing is that only first-class machinery be purchased, and that with a definite plan of development in mind. A new condensing turbine in an old simple engine plant will soon pay for itself and provide a way for an adequate boiler plant.

The rebuilding of the station, however, did not solve all the difficulties. This is proved by the fact that there are many fully equipped plants operating at efficiencies that are very poor. Taking stock of the situation after the first year's operation of the new plant showed an average fuel consumption of 4.17 lb. of coal per kilowatt-hour. This, of course, was an improvement over the former rate of 7.67 lb. per kilowatt-hour, both rates being made with fuel averaging about 11,000 B.t.u. per pound, but the results were a long way from what was expected.

Such a situation is doubtless familiar to many. Here was a modern station equipped with automatic stokers, with automatic control of fire and draft, with combustion recorders, recording thermometers, flow meters, weighing apparatus, wattmeters and the like, and still with a fuel consumption far in excess of what it should have been.

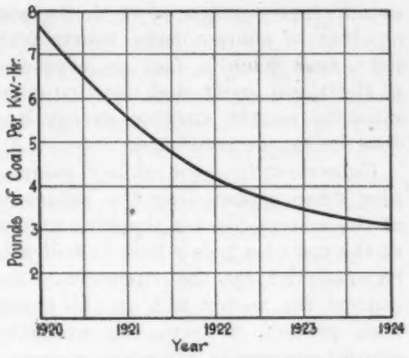
A complete set of plant records



TRAINING OPERATING FORCE INCREASES EFFICIENCY OF PLANT

was instituted during the next year. From study of them it became evident that the trouble lay in the manner in which the plant was operated. It was decided that the men employed at the plant, while not lacking in good intentions, either did not understand or did not realize the importance of watching the small things. Only the chief engineer understood anything about combustion, and an effort was made with his assistance, supplemented by power-plant magazines and books, to train the rest of the men. They were hard workers and loyal to the company, but their education was very limited, some of them not even being able to multiply or divide, and the attempt to educate them in this manner was a failure. In some localities it would have been easy to let these men go and get others better qualified, but this was in a farming community and men suitable for plant work who would be permanent and loyal were hard to get. In desperation the men were finally told that if they could not secure certain results in pounds of coal per kilowatt-hour it would be necessary to get new men in their places.

While the results were being watched it was decided to try still another scheme. The idea of teaching the men why such things were thus and so was given up, and they were told that round charts were wanted on the feed-water thermometers, that something else was wanted on another chart, and were furnished with simple instructions concerning what to do and what not to do. They were also told that they



MODERN METHODS APPLIED TO SMALL PLANT RESULT IN HIGHLY ECONOMICAL OPERATION

would receive a bonus if certain results were obtained. The bonus was based on savings in coal per kilowatt-hour, and the schedule was as follows:

Pounds of Coal per Kilowatt-Hour	Bonus per Month per Man
4.0	$0.00
3.9	1.00
3.8	2.25
3.7	3.75
3.6	5.25
3.5	7.00
3.4	9.25
3.3	11.75
3.2	14.50
3.1	17.50
3.0	20.75

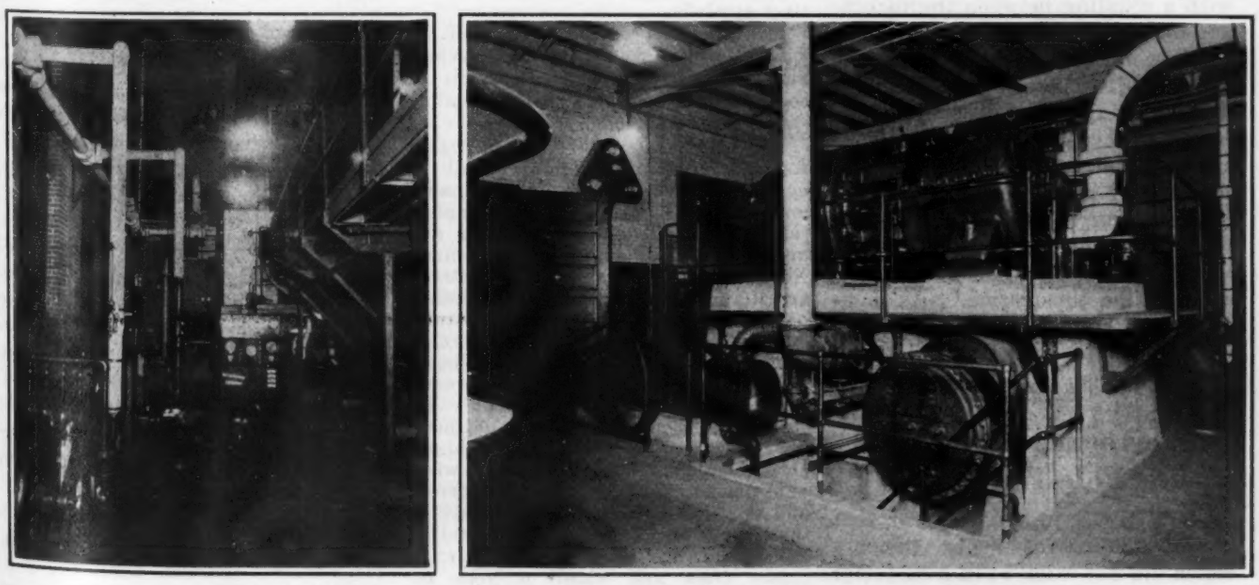
There was nothing complicated about it, and the men all understood the arrangement as well as the instructions which were given them. The result was almost instantaneous; the fuel consumption began to fall, the bonus earnings increased and everyone was enthusiastic.

A further study was made to see what could be done to improve conditions. The men were working twelve hours a day and there were many absences for various reasons. It was decided to put them on an eight-hour day and pay them by the hour. This also had a good effect.

About this time the interior of the plant was being painted and all the machinery and piping was painted and varnished. Every piece of equipment in the plant received a factory finish. This was done in preparation for an "open-house week" for the public. Besides giving the public a favorable impression, there was a good effect on the employees. They became proud of the appearance of the plant, and little effort is required to get them to keep the plant and machinery clean and in first-class condition.

By thus appealing to the men through their pride and through their pocketbooks and their working conditions a steadily declining fuel consumption has been attained. Of course, there has been an improvement in load factor which has been of material assistance, but the improvement in the men has been the greatest. These methods succeeded where others failed. These men now know the difference between a good CO_2 chart and a poor one. Low percentage of CO_2 means not only a hole in the fire probably, but also one in their bonus. The daily chart of operations which was put up originally for their edification is now a source of real information to them.

The best result for a day's run that has been attained is 2.57 lb. of coal per kilowatt-hour, or about 28,800 B.t.u. The best result for a month's run is 2.96 lb. of coal per kilowatt-hour, or about 32,400 B.t.u.



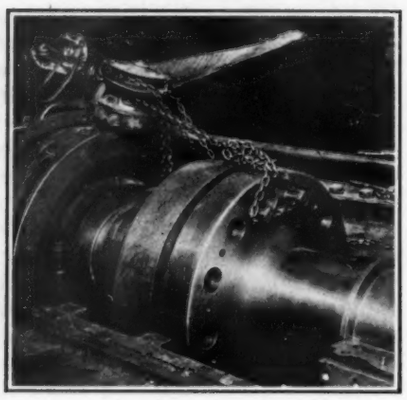
REMODELED 2,300-KVA. PLANT REDUCES COAL CONSUMPTION BY ATTENTION TO DETAIL

When the water rate of the turbines is considered, this compares very favorably with the results obtained in the best of the major stations.

Utilizing Generator When Turbine Is Shut Down

BY JOHN ORAM
Engineer Dallas (Tex.) Power & Light Company

WHEN turbo-generators are shut down either for periodic inspection or because of some breakdown, it is often the turbine and not the generator which needs attention. On systems where the generator units can be utilized to advantage for power-factor correction it is an advantage to be able to operate the generator separately from the turbine under such conditions, or even when the unit is sent down because



COUPLING BETWEEN TURBINE AND GENERATOR IS EASILY DISCONNECTED

of load conditions. For these reasons the Dallas Power & Light Company is equipping its new turbo-generator with a coupling between the turbine and the generator which can be readily disconnected. Even when the turbine is in operating condition, it is an advantage to disconnect this coupling when it is desired to operate the generator as the power-factor corrector, because otherwise considerable steam is wasted in the turbine to prevent overheating. One of these couplings is shown in the accompanying illustration. As indicated, the bolts fastening the couplings together can be readily removed.

Transformer Cases Used for Pole-Top Meters

ALTHOUGH it would appear that the finding of meter jumpers which did not exist when a customer first used service should constitute prima facie evidence of deliberate stealing of energy, some courts will not admit such a fact as evidence of theft and insist that the customer must be caught stealing energy before he can be convicted.

Consequently some utility companies when questioning the accuracy of the meters place a checking meter at the top of a pole where it will not be observed by the customer. To conceal the meter and at the same time protect it from the weather, several companies are placing checking meters in empty transformer cases provided with a peephole in the front to permit reading the meter dial. One company which found this necessary has adopted pressed-steel transformer cases provided with terminals exactly like an ordinary transformer. The peephole in the front is covered with a shutter which can be swung to one side. If sufficient light does not enter the peephole to permit reading the dial, the top plug in the transformer is opened or a flashlamp used.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Distribution Sketches

Sketches. — Work order estimates shall be accompanied by a sketch showing the proposed work. This sketch shall show clearly the exact location of all principal points such as substations, railroads, rivers, principal streets or highways; name of city or borough or, if in the country, name and direction of nearest cities or boroughs, and shall show the points of the compass. Locations shall always be clear enough so that they may be readily found on distribution maps or topographical sheets. In general, distances shall be actually measured on the ground and inserted on the sketch. Curb, property and lot lines should be shown accurately, and also any houses or buildings to which reference is made in the estimate. Buildings of present customers, of new customers who have signed contracts, of active "prospects" for future service and new customers who have signed contracts, of active "prospects" for future service and of possible "prospects" who do not desire to consider service at the present time shall always be shown by different and distinct symbols.

All poles, set or proposed, shall be spotted on the sketch and their ownership indicated by proper symbols or code, the key to which shall be plainly shown on the sketch.

All equipment on poles, as transformers and street lamps, shall be completely identified, giving number and complete rating, etc. Complete ratings shall always be given for any proposed new or additional equipment. Note should be made of all lightning arresters, branch cut-outs, secondary ground connections, guys, guy stubs, guy anchors, etc. If there are foreign attachments on the poles, brief notes should indicate such and their owners.

All conductors shall be plainly indicated, using proper symbols and showing the type—as primary, secondary, series circuit, etc.—number of wires and phases, rated voltage or current and the size of the wires. The sketch shall show the direction and source of each circuit and also where the circuit comes from and where it goes to. Where services are shown, the type, voltage, wire size, etc., shall be indicated.

Sketches for additions to local distribution shall show, in addition to proposed transformers and secondaries, existing adjacent transformers and usually their secondaries and services.

Any features of special importance, such as railroads, street railways, rivers, etc., must be plainly shown. Foreign pole lines shall be spotted, particularly where there is any case of crossing, overbuilding or paralleling. The reason for any special construction, such as building or tree clearance, unusual conformation of the ground, etc., shall be noted on the sketch, using a small detail sketch or profile of the ground set apart from the main sketch if necessary. Particular care should be used to give complete information where any right-of-way or surveying procedure will be required.

Illuminated Street Guides for Residential Streets

BY TERRELL CROFT
Directing Engineer Terrell Croft Engineering Company, St. Louis

AN EXCELLENT example of center-street illuminated guides may be found in the recent installation at University Heights, a residential section of University City, Mo. These posts were installed primarily as street location guides. After many conferences and preliminary designs the standard shown in Figs. 1 and 2 was adopted. Twelve of these guides are now giving satisfactory service, while a trial sample has been in use for over a year.

Energy for illuminating the guides is purchased on a flat-rate sun-down-to-sun-up basis from the Union Electric Light & Power Company. It is obtained from that company's series underground street-lighting circuits. A buried, armored, two-conductor cable carries the energy

FIG. 1—STREET-LOCATION GUIDES OF NEAT DESIGN

from just inside the curb, where the guidepost cable taps the street-lighting cable, to and up inside of each post to its luminaire.

Concrete, cast in conical form above street grade and extending cylindrically for 2 ft. below grade, constitutes the base. Hollow ornamental cast-iron columns of standard design were employed for standards. Each is held to its base with four ¾-in.x18-in. anchor bolts. For the luminaires a special design (Fig. 3) is used. It consists essentially of a hollow sheet-and-cast-bronze box, which has open sides and an open bottom. In the sides are inserted the glass street-name panels. Panels of clear glass are placed in the bottom. Over the circular opening in the top of the luminaire is clamped a hemispherical ruby-glass bowl, 12 in. in diameter.

At night, when the incandescent lamps within the luminaire are in operation, the street signs and the ruby bowl are well lighted and of pleasing appearance. Light is projected downward from the lamps, through the clear-glass panels, to illuminate the concrete base, which is painted white. Each luminaire is held in an annular recess which forms the top of the cast-iron standard. The luminaire may be rotated to any desired position and there held with the set screws of the standard, which pass through holes in the base ring to the luminaire.

Each luminaire is equipped with two 40-cp., 6.6-amp. nitrogen-filled series incandescent lamps. The two lamps are connected in series and are served from the existing series street-lighting circuits. Two lamps were employed in each unit to minimize the possibility of a unit becoming "dark." If one of the lamps does fail, the sheet-steel partition will cause one-half of the luminaire to show a decreased brilliancy.

Fitting around in the top of each luminaire is a white enameled sheet-steel reflector. Its function is to throw light downward, through the clear-glass panels, onto the concrete base of the unit. The bases are thus illuminated to minimize the possibility of collisions with them.

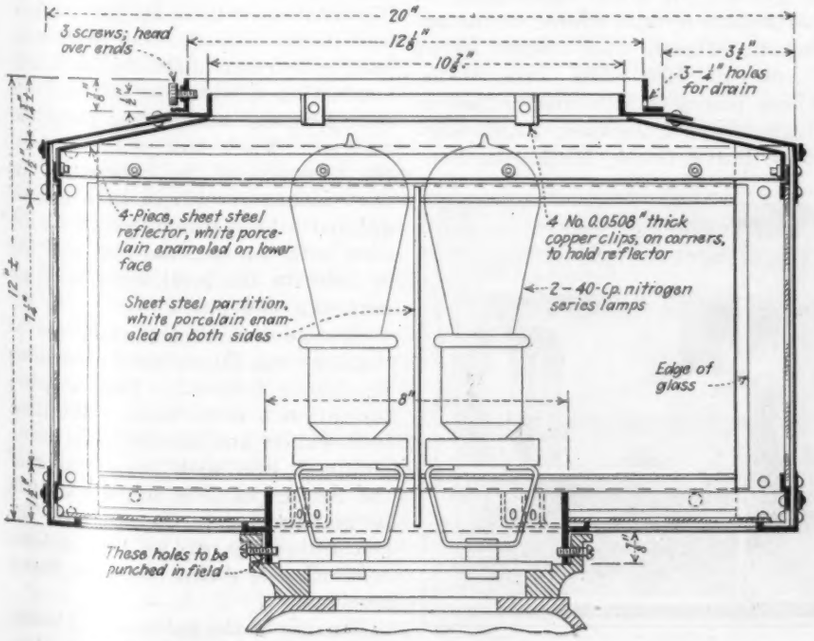
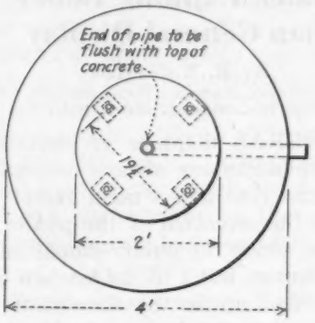

20"
3 screws; head over ends
12⅛"
10⅞"
3½"
3—¼" holes for drain
4-Piece, sheet steel reflector, white porcelain enameled on lower face
4 No. 0.0508" thick copper clips, on corners, to hold reflector
2—40-Cp. nitrogen series lamps
Sheet steel partition, white porcelain enameled on both sides
Edge of glass
8"
These holes to be punched in field

FIG. 2—DETAILS OF STREET GUIDES LIGHTED BY TWO 40-CP. LAMPS



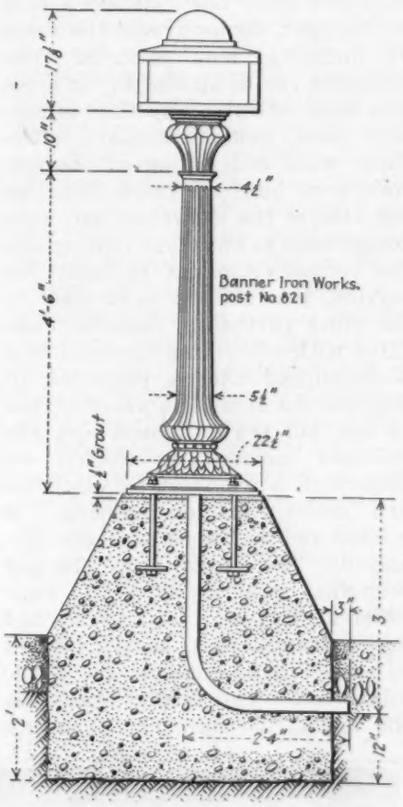


FIG. 3—THIS STREET GUIDE COST APPROXIMATELY $148

The guideposts, complete with their cable connections up to the street curbs, are owned outright by the property holders in University Heights, the ownership being vested in three trustees. The Union Electric Light & Power Company, from which the operating energy is purchased, will be paid by the trustees for maintaining the guides. Each guidepost, installed complete with cable and glassware, cost approximately $148.

Central Station Business

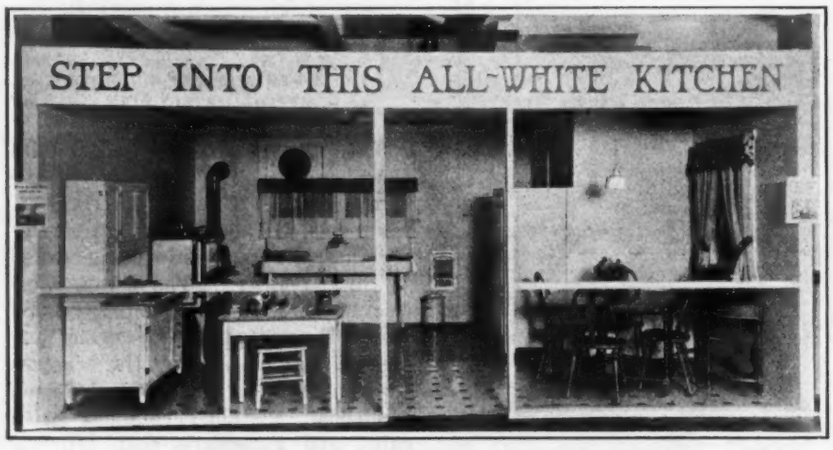
Model Exhibits Better than General Display

By R. E. Naylor
New-Business Manager Southwestern Gas & Electric Company, Shreveport, La.

GENERAL displays of electrical appliances are always necessary and must continue a main factor in calling the attention of the public to devices which the public should have in its homes, but a model kitchen exhibit fitted up in the showroom of the Southwestern Gas & Electric Company, Shreveport, La., to represent how every one's kitchen should be equipped, demonstrated the value of picturing how electrical conveniences can be applied to the home in a more effective way than is possible with general displays. The three walls and ceiling of the kitchen were built of plaster board at one side of the showroom and were conspicuous to every one coming into the company's offices to apply for service, pay electric light bills or for other purposes. The room was fitted with everything essential to a well-equipped kitchen, regardless of whether the apparatus was electrical or not, but the equipment specially featured included an electric refrigerator, a window-type ventilator and modern kitchen lighting. A washer and an ironer were also displayed. The display was changed somewhat from day to day to show different makes of equipment, and demonstrators were always present to answer questions that the public might ask. The exhibit was near the application desk of the utility company, and it was therefore easy for inquirers to gain any information desired regarding wiring, rates or similar matters.

The usual advertising methods were followed, but all of the publicity did not have to be paid for. Some of the local newspapers were sufficiently interested to carry an announcement regarding the exhibit in their news pages. School teachers were invited to bring in their domestic science classes, and prizes were given for the best essay on equipping the home with electric service. In each case the prize was an electrical device. Through the stimulation of the essays, the utility company was enabled to bring the subject into discussion in the schools, and investigations made later showed that the students did much missionary work in their own homes by discussing the exhibit and the preparation of the essays.

While the model kitchen exhibit has been discontinued for the time being, it is believed that this method of calling the attention of the public to domestic uses of electrical appliances is so effective that the same methods may be employed for showing the use of other appliances in other rooms of the home.



KITCHEN EQUIPPED TO SHOW ELECTRICAL APPLICATIONS

Home-Lighting Contest in 160 Towns

Consumers Power Company Appropriates the Sum of $25,000 to Bring 159,000 Michigan Homes Into Active Participation in the Movement

AS THE direct outcome of steps taken by the Consumers Power Company of Michigan to promote the nation-wide "better home-lighting" campaign of the Lighting Educational Committee, the greater part of that state is entered in the contest, the Consumers Power Company's territory of 24,000 square miles representing 85 per cent of Michigan's urban population outside of Detroit. A direct opportunity to participate is thus offered to the occupants of more than 159,000 wired homes in 160 cities and towns. These places include such cities as Grand Rapids, Jackson, Flint, Saginaw, Battle Creek, Muskegon, Pontiac, Kalamazoo, Bay City, Owosso, Hastings, Alma, Manistee and Cadillac, with 146 other communities adjacent and in the operated districts of the company.

At a meeting held in Jackson under the direction of C. W. Tippy, vice-president and general manager, the general committee completed the working plans for the state-wide organization and inaugurated the detailed operation of local activity. The contest will be staged in fourteen units, corresponding to the company's fourteen districts, each unit conducting a complete and self-contained contest within that particular district. Each unit will be under the direction of the company's district manager. He in turn has organized a local committee in accordance with the national plan and will co-ordinate the local newspaper advertising and publicity.

The general recommendations of the Lighting Educational Committee are being followed. The co-operation of local educational authorities, both public and parochial, is being obtained, and with the opening of the fall school term active work will be inaugurated in the schools. The material prepared by the national committee is being used in liberal amounts.

Because of the far-reaching potentialities of this contest, not alone

in the development of better home lighting but also in promoting good public relations as the result of improved living conditions, the Consumers Power Company deems it wise to utilize every possibility of the movement. A budget contemplating the expenditure of $25,000 in promoting it has been approved. In organizing for co-operation with the local electrical interests, the company is advancing $2 for every dollar subscribed by them. Seventeen newspapers, with a total circulation of approximately 411,000, are being utilized. This will cover every community eligible. Where time permits electrical homes will be open in the larger cities.

More than two hundred local prizes have been authorized. These prizes are being selected with a view to arousing the liveliest interest among the young. For example, in the city of Jackson, with 11,400 wired homes and a school enrollment of 17,000, twenty-eight prizes (fourteen each for boys and girls) of a total value of $480 are provided. These are divided as follows:

	Value of Prizes		
	Boys'	Girls'	Total
First	$75.00	$75.00	$150.00
Second	40.00	40.00	80.00
Third	30.00	30.00	60.00
Fourth	20.00	20.00	40.00
Next five at $10	50.00	50.00	100.00
Next five at $5	25.00	25.00	50.00
Total	$240.00	$240.00	$480.00

"Every electric utility in the country," Mr. Tippy says, "owes it to itself and its home-lighting development to be actively and prominently identified with this nation-wide contest. Its results are going to be far-reaching and will react beneficially in many and lasting ways. In fact, the splendid program of national advertising and publicity announced by the committee is of such weight that no utility can afford not to capitalize the interest it will create.

"We expect to enter at least 250 contestants in the national final contest from the communities served by the Consumers Power Company, and it will be a matter of local and state pride to develop the best possible interest here, that Michigan may be well represented among the winners."

The general committee directing the contest for the Consumers Power Company consists of W. M. Lewis, Muskegon; J. A. Cleveland, Grand Rapids; J. K. Swanson, Saginaw; J. F. Mayo, H. H. Balkam and Donald M. Mackie, Jackson.

Another Courtesy Card for Telephones

TO SERVE as a constant reminder of the value of courtesy, the card shown here has been placed on the mouthpieces of all telephones used by the Public Service Company

THIS TELEPHONE
AFFORDS an opportunity for your courtesy to broaden the Company's reputation for cordial relations. In its daily use, remember that so far as the person at the other end of the line is concerned —
You Are The Company

of Northern Illinois. It has been found an excellent means of improving cordial relation between customers and employees since it acts as a check against discourteous speech in using the telephones. Attention is called to the fact that, regardless of the position or rank of the person talking, he at that time is the company's sole representative

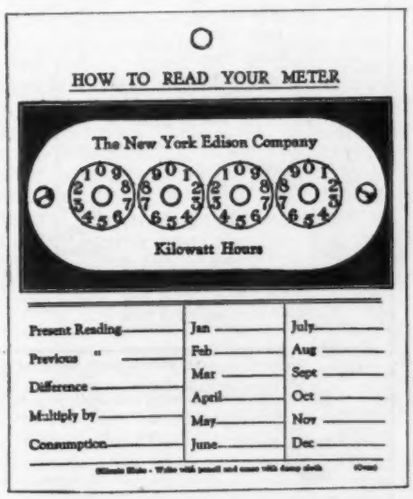
Card for Customer's Record of Meter Readings

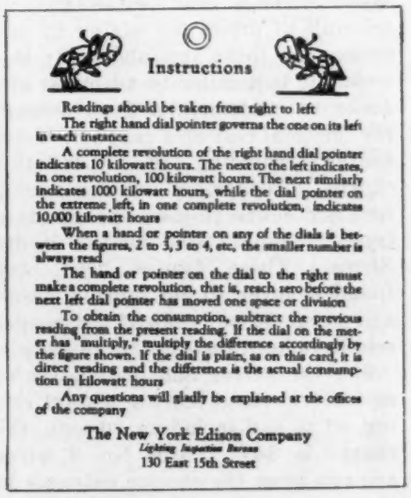
TO TEACH customers how to read their electric meters and encourage them to keep a month-to-month record of their energy consumption the New York Edison Company has distributed a 4-in. by 5-in. card which can be hung up conveniently near the meter. Both sides of this card are shown in the accompanying illustration, one side carrying simple but complete instructions for reading the meter, figuring a constant and obtaining the energy consumption. The other side represents a meter dial below which blank space is provided for present and previous readings, difference, multiplier (if the meter has a constant) and consumption. Space is also provided for keeping a record of the amount of energy used by months for a twelve-month period. The card is made of silicate slate and if written on with a lead pencil can be washed off clean with a damp cloth so that a new calculation may be made each month.

Group Insurance Extended by Narragansett Company

THE Narragansett Electric Lighting Company, Providence, which was one of the first public utility corporations to give its employees group life insurance, has found this protection so popular with its workers that it has made additional amounts available to them at very low rates. Under the company's plan the amounts of free insurance are graded according to the length of service of employees. Those with the company three months and less than one year receive $500 of protection, and an additional hundred dollars for each year of service up to the maximum amount of $1,000.

Under the new offer to employees each is permitted to have an additional $1,000 of life insurance at a cost of 90 cents per month, which is not varied by age or physical condition. The premium is deducted from the monthly pay, yielding insurance on the easy-payment plan. No employee is compelled to take the additional insurance.




Instructions
Readings should be taken from right to left
The right hand dial pointer governs the one on its left in each instance
A complete revolution of the right hand dial pointer indicates 10 kilowatt hours. The next to the left indicates, in one revolution, 100 kilowatt hours. The next similarly indicates 1000 kilowatt hours, while the dial pointer on the extreme left, in one complete revolution, indicates 10,000 kilowatt hours
When a hand or pointer on any of the dials is between the figures, 2 to 3, 3 to 4, etc, the smaller number is always read
The hand or pointer on the dial to the right must make a complete revolution, that is, reach zero before the next left dial pointer has moved one space or division
To obtain the consumption, subtract the previous reading from the present reading. If the dial on the meter has "multiply," multiply the difference accordingly by the figure shown. If the dial is plain, as on this card, it is direct reading and the difference is the actual consumption in kilowatt hours
Any questions will gladly be explained at the offices of the company
The New York Edison Company
Lighting Inspection Bureau
130 East 15th Street

CARD CARRYING INSTRUCTIONS FOR METER READING AND SPACE FOR NOTING EACH MONTH'S CONSUMPTION

As this insurance could not be made available unless 75 per cent of the employees accepted the proposition, the new offer was very ably presented to employees through the company's internal house organ, the *Nelco News*. The editors acted as campaign managers, department correspondents making the solicitations among the employees. The campaign was to run ten days, but through the efforts of the solicitors and the generous response of the employees the 75 per cent quota was reached in five working days, and before the campaign was ended 897 of the 1,032 eligible employees had availed themselves of the offer. The *Nelco News* carried the plan and offer as set forth in its leading article in one issue, and other pages carried indorsements of the plan by the president, treasurer, general manager and general superintendent as well as by the presidents of the company clubs. Then "kickers" at the bottom of each page of the *Nelco News* dealt with the subject. One of these said, "No physical examination—just sign your name." Another said, "For the price of one homely necktie you can protect your family."

The insurance was put in force in the Travelers Insurance company, Hartford, Conn., which also carries the original group policy under which free life insurance is provided to employees.

Fixed Prices for Electric Range Installations

TO ENCOURAGE the use of electric ranges and other of the heavier energy-consuming devices by residential customers, the Toronto Hydro-Electric System, through its Hydro Shops has established a schedule of prices for wiring up and connecting these appliances. By this means it is possible to advertise and quote to customers a fixed amount for the total cost of a range or water heater, including the installation charge. The prices are for wiring into and connecting up the standard types of ranges sold by the Hydro Shops. These figures have been found to cover all but unusual cases, and about 90 per cent of the ranges sold have been installed on this basis.

For the wiring and installation of an electric range having a total rating up to and including 70 amp. the charge is $40. Three No. 8 wires are run from the service entrance to the range. For ranges having a total rating of more than 70 amp. up to 80 amp. the charge is $45. In the latter case No. 6 wire is used. In either case for an extra charge of $5 an additional 30-amp. capacity will be provided to supply an electric water or room heater.

A number of bayonet-type electric water heaters have been installed by residential customers. It is required, however, that water heaters be installed only if the customer also uses an electric range. For installing a 70-amp. range, and 3-kw. water heater the charge is $70. This includes the necessary plumbing and covering the hot-water tank with 2 in. of hair felt and one layer of asbestos air cell with canvass over all. The actual wiring and installation is done by contractors as the Hydro system does not maintain a wiring department.

While the foregoing fixed prices are charged customers for the work, the contractors are required to bid on each job. These bids are submitted on what is known as a contractor's wiring quotation form, which is shown in the illustration below. On the reverse side of this form space is provided for making a sketch or plan showing the layout for wiring with dimensions and thickness of walls. The contractors' quotations for this work are based on the amount of labor and material required, and in some cases these bids exceed the flat amount which the Toronto Hydro-Electric System charges the customer. In other cases, however, where there is very little work to be done, there is some margin of profit for the Hydro System. Over an extended period of three to six months the cost averages very close to a charge of $40 or $45 per installation.

At present there are approximately five thousand electric ranges in use in Toronto, and of this number 1,390 have been sold and installed by the Toronto Hydro Electric System since August, 1921. It is felt that the fixed schedule of prices for installation has been an important factor in effecting many sales.

Form 736—2M—7 23—99174

ORIGINAL

To Toronto Hydro-Electric System — Attention of Chief Inspector

CONTRACTOR'S WIRING QUOTATION NO.

Customer

Address

Description of work—Install standpipe, wires, service box, and connect up

Re-connect existing Lighting Circuits to New Service. (See reverse side for sketch.)

Quantity	Material	Amount		Labor, etc.	Hrs.	Amount
	Ft. Conduit standpipe			Wireman		
	Ft. Cable standpipe			Helper		
	"F" Condulet standpipe			Cartage		
	"LB" Condulet standpipe					
	Locknuts & Bushings					
	Amp. Seal Service Box			Inspection Fee		
	Iron Box					
	Meter Board			Total Labor, etc.		
	2 Pole cut outs Amps.					
	2 Pole cut outs "			Total Material (brought forward)		
	Main fuses "					
	Range fuses "			Grand Total		
	Heater Fuses "					
	Lighting fuses "			Deduct for allowance on material superseded and recoverable, see reverse side.		
	Ft. Wire for Range					
	Ft. Wire for Heater			QUOTATION PRICE		
	Ft. Wire for Cut outs					
	Knobs & Tubes					
	Circular Loom			Quotation Price to be in Hydro Office not later than A.P.M.		
	Heater / Range			Date:—		
	Conduit Heater / Range			(This space for office use only.)		
	Ground Clamps, Wire & Tape					
	Pipe Clips, Solder & Fed. Bush.					

No extras accepted unless properly authorized by the System beforehand.

We hereby agree, if accepted, to carry out the above work without delay and guarantee a first class job Mechanically and Electrically, and subject to approval of Hydro-Electric Power Commission of Ontario.

Phone No. ..... Name .....

Date ..... Address .....

FORM USED BY CONTRACTORS IN PREPARING BID ON RANGE INSTALLATION

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Saginaw River Steam Plant of Consumers Power Company. — Prominent features of the initial 40,000-kw. installation of this 100,000-kw. plant are the preheating of feed water and combustion air with steam bled from three stages of the main turbines, the conservation of radiated and blow-off heat, water sides in boiler furnaces, sluicing of ashes and two-motor fan drives. Steam pressure is 375 lb. gage, superheat, 240 deg. F., and final steam temperature 684 deg. The total plant cost $71 per kilowatt, which includes everything going to make the plant, such as railroads, buildings, mechanical and electrical equipment, intake pumping station with circulating water ducts and all overhead, engineering and interest during construction.—*Power*, July 22, 1924.

Wooden-Stave Pipe Lines and Penstocks.—J. B. HOLDCROFT.—The more important consideration involved in the design of wooden-stave pipe employed for hydraulic power installations are reviewed by the author. Douglas fir is being used almost entirely in the manufacture of these pipe lines. The size of staves to use and the design of tongues, bands and cradles are considered. — *Canadian Engineer*, July 15, 1924.

Generation, Control, Switching and Protection

Lightning Arresters. — The editor gives advice for protection of an overhead 220/380-volt system against electrical disturbances caused by lightning. He recommends for this protection (a) a well-grounded wire mounted above the conductors, (b) the use of the simplest lightning arresters that can be inspected easily at sight, (c) installation of reactors between the line and all apparatus connected to it, and (d) the use of meters in which the voltage coil can be quite easily replaced.—*Sterkstroom (Holland)*, June 18, 1924.

Protection of Steam-Turbine Disks from Axial Vibration.—On account of the rapid increase in turbine capacities during the war period the mechanical possibilities were pushed to the utmost. The use of single-row bucket wheels and high velocities led to disks of larger diameter. Turbine failures of an erratic nature proved to be caused by fatigue effects of backward traveling waves in these disks.—*Power*, July 15, 1924.

Relay Practice. — H. H. GREEN. — Satisfactory relay operation depends to a large extent upon the attention given to the maintenance of the relays after they have been properly installed. The practice outlined by the author has been used with satisfactory results on a large transmission system having to contend with lightning and sleet conditions more severe than the average. The study and development of relay protection for the system was begun slightly less than five and a half years ago, soon after it came into existence as a system. The main problems encountered are probably not unlike those found in other similar systems, but it is true that certain special conditions will be found which cannot be taken care of by any general scheme of protection. The general practice which has been followed in maintaining and developing the protective relay equipment is outlined, and some of the problems encountered and difficulties met in the carrying out of this program are included. In addition, the methods of keeping records of relay performance and maintenance are described.—*Electrical Journal*, July, 1924.

Transmission, Substations and Distribution

Saturated-Core-Type Regulator and Reactor.—D. K. BLAKE.—This paper states briefly the use of voltage regulators and reactors, transmission and distribution systems, with a discussion of the operating requirements which might be best met by the use of the saturated-core type of regulators or reactors. The apparatus consists of an iron core with two sets of coils, one of which is connected to a direct-current and the other to an alternating-current circuit.—*Journal of A. I. E. E.*, July, 1924.

Lightning and Other Transients on Transmission Lines.—F. W. PEEK, JR. —In this paper, to be presented at the Pasadena convention of the A. I. E. E., the author co-ordinates the work that has been done on this subject with a view of determining the various types and the order of magnitude of the predatory voltages to which transmission lines are subject. He shows that the voltage of a severe lightning flash is probably of the order of 100,000,000. The current may be 78,000 amp. and the stored energy 13,500 kw.-sec. The discharge is usually non-oscillatory and often takes place in a few microseconds. Most lightning disturbances on transmission lines are steep-wave front impulses that occur by electrostatic induction. A single ground wire when properly installed under favorable conditions reduces the induced lightning voltage to 48 per cent of that without a ground wire; for two ground wires the reduction is 34 per cent, and for three ground wires it is 24 per cent. Insulating inductive apparatus to withstand lightning voltages is a greater problem than simply adding insulation. Shields to prevent localization of stress are important and function in a manner somewhat similar to that of the ground wire. The extent to which protection should be used is a combined engineering and economic problem, determined from the engineering standpoint by strength of apparatus and the voltages to which it is likely to be subjected. With these factors known, the economic problem is to balance the cost of insurance against the value of better service and reduced liability of trouble.—*Journal of A. I. E. E.*, August, 1924.

Units, Measurements and Instruments

Value of Commercial Magnetic Testing.—T. SPOONER.—The value of magnetic measurements is obvious when used in research work involving the development of new or improved magnetic materials. Often, however, the full value of magnetic testing is not completely realized when considered in connection with routine inspection. The author points out not only the more or less obvious uses of such an inspection but some which are not so obvious. The most important type of magnetic material, on the basis both of tonnage and of value of annual output, is electrical sheet, that is, the material which is used for the cores of electrical apparatus. Test methods and the significance of test values for electrical sheet are discussed. — *Electric Journal* August, 1924.

Calorimeter for Steam Investigations Developed by Bureau of Standards.— As its share of the A. S. M. E. steam-research program the Bureau of Standards has assumed the task of redetermining the amount of energy in one heat unit and of measuring the heat content of water and latent heat of vaporization up to as high a pressure as possible (probably 1,200 lb.). The calorimeter is a shell of copper-nickel alloy, heavily silver-plated inside to resist corrosion by the hot water. Measured amounts of heat are introduced into the inclosed water by an electric heater. An extremely small centrifugal stirring pump within this shell circulates 800 lb. of water per hour. A refined method of experimenting has been developed to insure the utmost reliability in results.—*Power*, Aug. 12, 1924.

Illumination

Photometry as Related to Illuminating Engineering. — W. F. LITTLE.— Illuminating engineering depends for its existence upon photometry. Illuminating engineering is the end and photometry the means. However, it is none the less important that the engineer be familiar with and understand the tools with which he works. In this article a brief outline of photometric problems and photometry is presented. This is divided into two sections—the elements of photometry and their application to engineering problems.—*Transactions of the I. E. S.*, July, 1924.

High-Power Transparent Illumination.—CONRAD BECK.—Transparent or transmitted illumination, in which an object is examined against a bright background, is used more than any other in microscopical examination. It is a method that is not often employed for other purposes, and its characteristics are not well known because they are seldom observed in ordinary occupations. The author discusses the

characteristics of transparent illumination and the precautions to be taken in order to reduce glare and flooding. —*Journal of Scientific Instruments* (*England*), July, 1924.

Distribution of Luminosity in a Neon Glow-Discharge Lamp. — E. KARRER and A. PORITSKY. — The authors describe in detail observations of how the luminosity in a neon glow lamp is distributed throughout a potential cycle. These observations were made with an oscillograph, and the method is applicable in the study of other cases of luminescence.—*Journal of the Franklin Institute*, July, 1924.

Motors and Control

Marine Progress.—The entire issue is devoted to electricity as used in the marine industry. Some of the subjects discussed are wireless on shipboard, motors for ship propulsion, power for marine purposes and propelling machinery.—*Electrician* (*England*), July 25, 1924.

Control of Synchronous Motors.—H. D. JAMES and J. H. GRAYBILL.—There are two general methods for starting synchronous motors automatically, and both methods provide for changing the field connections when the motor reaches synchronous speed. Both methods may be used for starting at a reduced voltage with an autotransformer or for connecting the motor to full voltage. These schemes of control are modified if a direct-connected exciter is used. The two schemes are known as the field-frequency method and the time-element method, and both methods are described in detail.—*Electric Journal*, July, 1924.

Canadian Paper and Pulp Industry.—A review of the present situation in Canada in regard to the use of water power by the pulp and paper industry as prepared by the Dominion Water Power Branch is given. The general conditions in each province as regards types of drive, availability of power and production are considered.—*Electrical News*, Aug. 1, 1924.

Electrophysics, Electrochemistry and Batteries

Variation of Magnetic Potential.—A. A. AHMED.—The magnetic potential along the surface of a cylindrical core is investigated mathematically, the solution being limited by two hypotheses (1) that the exciting coil consists of a thin layer of many turns of wire and (2) that the permeability of the core is great compared with that of the surrounding air. A general expression for the potential due to a cylindrical pole magnet is first derived, followed by the special case under consideration. — *Electrician* (*England*), Aug. 1, 1924.

Insulating Varnish Tests. — H. L. HAZELTINE.—The author describes some simple tests and gives an interpretation of results that make it possible to "check up" on varnishes used for different insulating requirements and to select the type of varnish best suited to the conditions to which the apparatus is likely to be subjected. This is the last of a series of articles. The first article appeared in the March issue and dealt with varnishes and their solvents. The second, in the April issue, took up methods of applying varnishes. The third, in the June issue, discussed the best ways to use varnish for protecting windings against moisture, oil and metallic dust. The fourth article, in the July issue, outlined common insulation troubles and explained the ways to overcome them. —*Industrial Engineer*, August, 1924.

Heat Applications and Material Handling

Mine Hoisting.—F. L. STONE and F. R. GRANT. — The authors show some results that have been obtained from actual installations of electrically driven mine hoists which have been designed to meet calculated cycles.—*Journal of A. I. E. E.*, July, 1924.

Six-Ton Induction Furnace Installation.—M. UNGER.—Following the satisfactory results which attended the installation and operation of a 2-ton induction furnace at its Pittsfield works, the General Electric Company has placed in operation a furnace of similar design but of three times the capacity. The author describes the new furnace and its auxiliary apparatus and explains how its principle of operation results in a high-grade melt of extreme uniformity.—*General Electric Review*, August, 1924.

Telegraphy, Telephony, Radio and Signals

Performance and Theory of Loud-Speaker Horns.—A. N. GOLDSMITH and J. P. MINTON.—The study reported in this fifty-five-page article should lead to a comprehensive understanding of the performance of loud-speaker horns. The data presented should also lead to new and improved types of loud speakers. By means of a vacuum-tube oscillator to operate a loud-speaker unit and a calibrated condenser transmitter, a resistance-coupled amplifier and a thermocouple and galvanometer, tests were made at various frequencies to obtain the sound output from straight conical horns. The results obtained are analyzed, and equations for pressure, velocity, sound radiation and phase of the unlimited straight pipe and exponential and parabolic horns are reviewed and developed. The solution for horns of finite length is worked out and briefly described. Equations for the direct and reflected sound energy from the open end of a horn are also derived.—*Proceedings of Institute of Radio Engineers*, August, 1924.

Radio Equipment for Mail Planes.—I. F. BYRNES.—With the inauguration of night flying as a regular feature of the transcontinental air-mail service, it is increasingly important that the pilot be able at any time to communicate with the landing stations. The difficulties attending the design of suitable radio transmitting and receiving equipment for this service are described in detail. One of the very important factors is space limitation and the necessity for apparatus capable of easy adjustment and operation, so as to prevent interference with the pilot's control of the plane.—*General Electric Review*, August, 1924.

Transient Phenomena in Coupled Circuits.—E. E. WITMER.—There is a device in common use for measuring the velocity of magnetized projectiles which records the instant of passage of the projectile through a circular coil by means of a chronographic record of the currents induced in a circuit in series with or magnetically coupled with that coil. Since these circuits contain inductance, the currents will not in general be in phase with the electromotive force, which means that there will be a small time error in the determination of the instant of passage from the current curves. For accurate work it is desirable to know these time differences. Since the fundamental differential equations for coupled circuits are known, this problem can be solved mathematically, which the author does in this highly theoretical paper.—*Journal of the Franklin Institute*, August, 1924.

Capacities of Small Air Condensers.—L. HARTSHORN.—The most general case of a condenser is considered, i.e., any two conductors in a dielectric medium. Taking Maxwell's equations for the potentials and charges, it is pointed out that several definitions of capacity are possible, giving slightly different values in any one case. One of these is independent of earth effects. In order to consider the case of a condenser carrying alternating current, the general equations of currents and potentials are written down. In general the effective capacity is seen to depend on the potential distribution and earth effects. The desirability of making the effective capacity depend on the geometry of the system and the nature of the dielectric only is pointed out, and the conditions necessary for this are deduced. Examples of the practical realization of the conditions are given, and the importance of these considerations in the case of shielded air condensers is indicated.—*Journal of Scientific Instruments* (*England*), July, 1924.

Traction

Automatic 1,500-Volt Direct-Current Substations.—The engineer in applying automatic substations to an existing electrified traction property is often forced to make the most of a poorly designed or antiquated distribution system. By comparison, the problem of designing the distribution system for the electrification of a steam railroad is often very simple. The choice of proper converting equipment is perhaps not so easily made. The author brings attention to a number of important points which should have careful consideration from those contemplating electrification.—*Journal of A. I. E. E.*, July, 1924.

Progress in the Electric Railway Industry.—A survey of recent financing, operating results, receiverships lifted, new track construction and purchases of rolling stock, covering the first six months of this year, shows that the railway industry is in an excellent condition. This survey also shows that several railway companies are taking over the operation of buses. —*Electric Railway Journal*, July 26, 1924.

News of the Industry

First Radio-Controlled Substation

Northern Indiana Power Company Installs New System by Which Service Can Be Switched from One Transmission Line to Another in Attendantless Plant

RADIO control of a complete electrical substation at Tipton, Ind., without the presence of a single attendant, has been perfected. By means of high-frequency waves emanating from Kokomo, Ind., about 35 miles away, and a receiving set much like the broadcast listener, switches can be operated and the light and power supply of Tipton controlled without the intervention of a human hand.

The Northern Indiana Power Company, which placed the system in operation after tests extending over a year, declares that it is the first time on record when radio waves from a distant point have been employed to operate a complete electrical substation supplying a city of 5,000 population.

To insure uninterrupted electrical supply for the city, two transmission lines are employed from power plants at Kokomo and Noblesville. In case of interruption of transmission on either line, such as is caused by storms, the supply can be resumed from the alternative source. Heretofore the operation of oil switches, used to change the connection, has necessitated the constant presence of substation assistants, who have received instructions by telephone from Kokomo. The telephone has not been invulnerable to storms, and at times great difficulty has been encountered.

Control by Oil Circuit Breakers

Under the new system, if trouble develops on either of the lines entering the station, which is controlled by two massive oil circuit breakers of 73,000-volt, 400-amp. rating, with a rupturing capacity of 1,500,000 kva., it is instantly observed on power-house instruments at Kokomo. An operator sends out high-frequency waves, which open the oil switch at Tipton connected to the defective line and close the oil switch connected to the reserve line, the whole operation being completed in a few seconds.

The waves, which are sent out from Kokomo by operation of a dial similar to that used on an automatic telephone, are received by antennas at Tipton and led to a five-tube receiving set and amplifier. They are then carried to a series of selector relays, which in turn operate the storage-battery switches actuating the oil-circuit-breaker mechanism. The special wave length is outside broadcasting range, and the series of impulses is said to be as complex in its kind as the combination lock of a safe.

The wireless apparatus was designed to specifications of John Ferguson of Indianapolis, manager of operation of the company, and built by the Westinghouse Electric & Manufacturing Company. About six similar stations may be installed in the state within the next year, Mr. Ferguson says.

Squier Loses Patent Suit

Federal Court Rules that "Wired-Wireless" Devices Had Been Given Freely to Public

BY THE ruling of the United States District Court at New York, handed down by Judge Knox on Wednesday, September 3, the patent infringement suit of Major-General George O. Squier, formerly chief signal officer of the United States Army, against the American Telephone & Telegraph Company has been dismissed on the ground that General Squier's patents were freely and openly dedicated to the public at the time of their issue and cannot be resumed. The patents in question are those covering not only the system of multiplex telephony used by the American Telephone & Telegraph Company but also the system of carrier current, or "wired wireless," perfected by General Squier and installed, by authority of a license from him granted to the North American Company, in the Borough of Richmond, New York City, and elsewhere.

The court found that in March, 1909, Congress appropriated $30,000 for experiments in wireless-telephone apparatus and put General Squier in charge of the work. About two years later, when the invention was completed, General Squier and his superior officer, General Allen, agreed that the device should be patented, for the protection of the federal government. The patents bore the inscription "Dedicated to the public." Subsequently, the court said, the plaintiff, in interviews with newspaper reporters and in speeches at dinners, meetings and before technical societies, affirmed the statement that the invention was free to all who might desire to use it.

Reaching these conclusions as it did, the court found it unnecessary to pass upon the second contention of the American Telephone & Telegraph Company, that even if General Squier's patents had not been given to the public, they were antedated by the Ruhmer Belgian patents in the same field, which have been acquired by the North American Company.

Leagues Gather at Association Island

Committee on National Organization Reports Comprehensive Plan for a League Council, Which Is Adopted by Conference

REPRESENTATIVES of the more important local electrical leagues of the United States and Canada met in conference on Tuesday of this week at Association Island, Henderson Harbor, N. Y., with more than forty leagues officially represented. W. E. Robertson of Buffalo presided. Because of the absence of W. W. Freeman of Cincinnati, president of the Society for Electrical Development, the formal ceremonies of flag raising, with an address by F. M. Feiker, were postponed till Wednesday.

Report on National Organization

Among the most important matters in the program was the report of the committee appointed last year on national organization of local electrical leagues. Of this committee Earl E. Whitehorne was chairman. The committee held three meetings, in Buffalo, New York and Atlantic City, and made a thorough study of the experience of national affiliation of local associations in other fields. As a result it proposed five articles of confederation, the purposes of which were thus stated:

A. To provide means for the systematic interchange of ideas and methods between leagues.

B. To promote new local leagues based on the best practices of existing leagues.

C. To develop certain standards and principles based on the experience of leagues throughout the country.

D. To provide for an annual conference of delegates of local electrical leagues.

E. To provide a League Council which may act for the local leagues in fostering the objective named in the foregoing.

F. To establish a working arrangement between the League Council, representing the local leagues, and the Society for Electrical Development, whereby the existing facilities and experience of the society may be utilized as a national clearing house for league activities and to provide a national service to local leagues.

The articles of confederation provide that the League Council shall consist of twelve representatives of the geographic sections of the United States, in accordance with the boundaries followed by the National Electric Light Association and the Lighting Educational Committee, one representative of Canada, and members from such additional important leagues as it may

seem desirable to have directly represented. This council is to represent the leagues in the interims between conferences, to act in an advisory capacity to the Society for Electrical Development in its league work, and to serve as a committee on policy wherever guidance is needed in the relations between the Society for Electrical Development and individual local leagues. It is recommended that this League Council be empowered to elect its own chairman and an executive committee of five men in position to attend meetings and take active responsibility. The services which it is proposed that the Society for Electrical Development shall perform are listed under ten headings. They include field organization service, the preparation of guide books, the issue of a monthly news bulletin and the provision of regular newspaper publicity.

The conference adopted the plan, but the election of the League Council occurred too late for announcement this week. This co-ordination of league activities is to be accomplished without establishing any burden of headquarters staff and expenses. The establishment of a financial program for the support of the work of the confederation and the problem of coordinating league activities and development is being referred by the committee to the League Council with recommendations.

"Red Seal" Campaign

A strong indorsement of the "red seal" campaign initiated by the Toronto Electrical League and now organized on a national basis was made by the league. Under this plan the Society for Electrical Development will license leagues to award the "red seal" emblem of adequate wiring on residence and apartment installations, placarding the house during construction and issuing a deed certificate and placing a red seal on the meter board after inspection. A large number of leagues have already applied for licenses.

One meeting was devoted to a discussion of the home-lighting contest with James E. Davidson, chairman of the Lighting Educational Committee, presiding, and the league showed great interest in supporting the campaign with local contests. Other sessions considered various aspects of league service to architects, builders, real-estate men, contractors, dealers and central-station companies in the development of the industrial, commercial and domestic market.

Los Angeles for Power-Bond Issue by Nine to One

The sixteen-million-dollar power-bond issue submitted to the voters of the city of Los Angeles on Tuesday, August 26, was carried by a sweeping majority. Virtually complete returns show 105,670 votes for the bonds and 12,783 votes against them. It will be recalled that two previously proposed issues have been defeated, one for $35,000,000 on June 19, 1923, and one for $21,000,000 on May 19, 1924. The sum of $16,000,000, now indorsed by the voters was fixed by the Railroad Commission at the request of the city as the amount reasonably necessary to carry out the three-year construction and betterment program of the city's Bureau of Power and Light.

New Commercial Plans

Section Resolves on Survey of Appliance Load and Regional Truck Meetings —Backs Range Survey

A FRANK discussion of the need for strengthening the usefulness and influence of the N. E. L. A. Commercial Section and of the reasons why the Sales Managers' Association enjoys a greater popularity with the older sales executives of the central-station industry took place at Chicago last week when the commercial bureaus and committees under the administration of Chairman W. R. Putnam, vice-president and general manager Idaho Power & Light Company, met at the Edgewater Beach Hotel. S. D. Heed, Cincinnati, who told of the benefits derived from meetings of the Sales Managers' Association, made a strong plea for a definite statement of the purposes of the Commercial Section and the principles under which it purposes to act. The appeal was repeated by E. W. Lloyd, Chicago, and it was apparent that under Chairman Putnam a very determined effort will be made to reestablish the Commercial Section in the confidence and interest of the central-station industry.

The Appliance Bureau, under Chairman T. F. Berger, Philadelphia, decided to conduct a survey of residence load in Cincinnati to determine the value of appliances in use at present, following the lines of the Philadelphia survey of several years ago. A study of the experience of Henry L. Doherty & Company and other holding companies and individual central stations will also be made to prove the importance of the appliance business, and a specific conception of the best method of selling some of the more important appliances will be developed. The fact that annual appliance sales today range from $4.50 to $40 per consumer was cited as evidence of the great need for enlightenment and as proof that the central-station companies need sales managers who can take with authority the initiative in the development of this market.

Regional Truck Meetings

The Electric Transportation Bureau, under Chairman B. G. Martin, Chicago, decided to continue the truck schools, so successful last year, in any cities where they are desired and to prepare as a supplementary activity a book on modern transportation practice and experiences, classified by industries, for use in any city in canvassing bakers, laundrymen and others. The material will also be put before the central stations in a series of regional truck conferences at which representatives of neighboring light and power companies will gather.

The electric cooking and heating committee voted to raise $10,000 additional to finance the electric range survey now being made by the Northwest Section, N. E. L. A. A. L. Smith, chairman manufacturers' range committee, was made responsible for obtaining this fund. The committeee assigned responsibility to the Pacific Coast appliance division for gathering data on experience with water-heater business on meter rates, and to the Great Lakes appliance division for a report on servicing and installing ranges. At present there is a wide variance in the cost of connecting ranges. In Portland, Ore., for instance, the cost is $25 and in San Francisco it is $70. A committee will be appointed to confer with the N. E. L. A. wiring committee and the committee on wiring of the Associated Manufacturers of Electrical Supplies and develop a standard practice for range wiring.

Chairman V. M. F. Tallman reported that the Power Bureau would continue the program for last year with special attention to industrial heating. The Lighting Bureau held no meeting, no chairman having yet been appointed. The customers' relations committee, F. F. Kellogg, Pittsburgh, chairman, reported that it has eight monthly bulletins already scheduled or in process.

At the final session James E. Davidson spoke as chairman of the Lighting Educational Committee, describing the purpose and progress of the campaign. John F. Gilchrist made an extremely interesting address dwelling upon the increased responsibility which has come to the commercial man with the greater cost of central-station plant and equipment. Since the beginning of the world war, he said, the station investment has swelled from say $75 per kilowatt to as much as $150 per kilowatt, thus placing a demand upon the commercial staff for the selective development of business that will pay a higher return.

Pennsylvania Men Convene

President Shearer Speaks of Growth of Interconnection and Improvement in Load Handling

WITH an attendance of 300, representing almost every county in the state, the Pennsylvania Electric Association opened its seventeenth annual convention at Bedford Springs on Wednesday, September 3. President J. H. Shearer of Altoona in his official address said that each day in Pennsylvania fewer communities are dependent upon one source of electric power or upon one transmission line for their service. He dwelt on the progress being accomplished by interconnection, by the building of duplicate lines and by improvement in load dispatching. Mr. Shearer also told of the wide sweep of the association's activities in many fields of the electric industry and cited the fact that forty committees, with a membership of 270 men and women, were engaged in a study of technical, commercial, accounting, public relations, rural lines, state-wide power survey and other problems.

Four addresses from men well known in the industry, besides a public policy meeting in the evening, were scheduled for Thursday, and on Friday the rural-lines committee was to report and Vice-president J. E. Davidson of the N. E. L. A. and others to speak. These sessions will be reported next week.

Insull Interests Get Brewer Utilities

Control of American Public Utilities Company, with Its Valuable Indiana Properties, Passes to Chicago Syndicate—No Consolidation Projected

CONTROL of the American Public Utilities Company has passed from Kelsey, Brewer & Company to Samuel Insull and associates, the United Gas & Improvement Company, the Middle West Utilities Company and the Midland Utilities Company, through ownership of the majority of the common stock, it was announced by Mr. Insull a few days ago. He stated that the American Public Utilities Company will be operated as a separate holding company and that no consolidation with his other interests is in contemplation.

The American Public Utilities Company, which has had its headquarters at Grand Rapids, Mich., under the presidency of Joseph H. Brewer, is a holding company which through stock ownership controls the Central Indiana Power Company, the Merchants' Heat & Light Company of Indianapolis, the Northern Indiana Power Company, the Indiana Electric Corporation, the Wabash Valley Electric Company and the Attica Electric Company, all serving Indiana cities and towns, and the Albion Gas Light Company, Albion, Mich.; Holland City Gas Company, Holland, Mich., and Utah Gas & Coke Company, Salt Lake City, Utah.

The Indiana subsidiaries give one or more classes of service to 135 cities and towns in twenty-seven counties, having a population of 550,000, and include a part of the business of Indianapolis and the entire business of the cities of Kokomo, Huntington, Noblesville, Wabash, Rochester, Clinton and Sullivan. Approximately 78 per cent of the companies' business is electric light and power. The Indiana Electric Corporation, one of the subsidiaries, recently completed the first two units of the large power station on the Wabash River adjacent to large coal-land holdings of the company.

The total investment of all the acquired properties is put at $88,000,000. Gross earnings of subsidiaries of the American Public Utilities Company for the twelve months ended June 30, 1924, were $7,760,631.

Publicity Plans of Lighting Educational Committee

Final plans for the last drive to get every city, town and hamlet in the United States and Canada organized for the coming home-lighting contest will be discussed at a meeting of the executive committee of the Lighting Educational Committee next Monday, when questions of policy which have arisen owing to differing conditions in various sections of the country will be discussed. The first national advertising begins on September 11 in the *Saturday Evening Post*.

A list has been published giving the names of 1,201 communities which have already signified their intention of participating in the contest. In another week it is expected that three thousand communities will be listed. Local newspaper advertising will begin in a great number of communities at the time the national advertising appears. Six radio talks for broadcasting stations are now available, and five of these will be released for each Thursday beginning with September 11. The sixth lecture is general in nature, and can be released at any time convenient to the local communities.

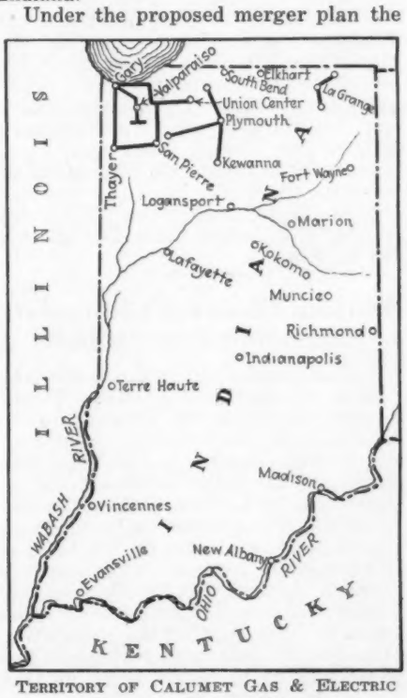
Ten thousand local prizes, totaling $7,500, for Chicago school children participating in the contest have been arranged by the committee in that city. The campaign will be advertised on 700,000 monthly bills of the Commonwealth Edison Company, and the local committee has ordered 50,000 primers and 75,000 announcement folders and cards.

Indiana Utilities in Merger

Fifteen Companies to Unite, of Which All But One Furnish Electric Light and Power

PLANS for the consolidation of fifteen electric light and power and gas companies serving fifty cities and smaller communities in northern Indiana are outlined in a petition filed with the Public Service Commission of Indiana.

Under the proposed merger plan the



TERRITORY OF CALUMET GAS & ELECTRIC COMPANY UNDER MERGER

Calumet Gas & Electric Company, with headquarters in Gary, will purchase fourteen other public utilities and merge their properties with its own. Samuel Insull is president of the Calumet Gas & Electric Company and Charles W. Chase of Gary is vice-president.

The utility companies in question are the Knox Electric Light & Power Company, Monterey Light & Power Company, North Judson Electric Company, Plymouth Electric Light & Power Company, LaGrange County Light & Power Company, Valparaiso Lighting Company, Consumers' Electric Company, Demotte Utilities Company, Hanna Light & Power Company, Kankakee Valley Electric Company, Kingsbury Light & Power Company, Union Electric Company, Wanatah-La Crosse Electric Company and the Elkhart Gas & Fuel Company. Some of these companies have been under the control and management of Mr. Insull and associates for some time, others having been acquired since the first of this year.

Most of the companies furnish electric light and power service, the only exclusively gas property being in Elkhart. The Valparaiso Lighting Company furnishes gas as well as electric service. Communities served are in Lake, Porter, Laporte, St. Joseph, Elkhart, Newton, Starke, Marshall, Fulton, Pulaski, LaGrange and Noble Counties. Some of the important towns served, besides Elkhart and Valparaiso, are East Gary, Crown Point, Lowell, Plymouth, Culver, Knox, North Judson, LaGrange and Wolcottville. These towns served are interconnected by an extensive electric transmission system, which with the local distribution systems totals 456 miles. The valuation of the properties of the combined companies is estimated to be substantially in excess of $4,000,000.

American End of New Transatlantic Cable Laid

On Tuesday of this week the Western Union Telegraph Company laid at Rockaway Beach, N. Y., the American end of its new transatlantic cable to Italy and thence to Germany. It is expected to be in operation as far as the Azores early in October and all the way to Rome before the end of the year. The cable is of a type never before laid down and which, it is said, will revolutionize the art of submarine cable service and provide a cheaper and better method of transoceanic communication than any that radio has yet in prospect. It will cost $7,000,000 to lay.

The cable embodies the use of an alloy of nickel and iron combined under certain conditions in the proportion of about 80 per cent nickel and 20 per cent iron and called permalloy. It has more than thirty times the magnetic permeability of soft iron and is applied in the shape of a single ribbon or tape, six-thousandths of an inch thick, one-eighth of an inch wide and a little more than 10,000 miles long. The permalloy tape is wound around the central copper core or conductor from one end to the other.

The conducting core consists of a single copper wire, around which are wound spirally six copper tapes. The total diameter of the conductor and its wrapping of permalloy is a fraction short of a fifth of an inch. This is surrounded by gutta-percha insulation, over which are protective wrappings of jute fiber and eighteen spirally wound galvanized-steel sheathing wires.

Power Dams and Fish

Experiments on Ability of Salmon to Negotiate River Barriers About to Begin

TO WORK out the possibilities of taking mature salmon over a high dam to the upper waters of the spawning rivers of the West, and then to get the young salmon down again, will be the purpose of experiments authorized by the Fish and Power Committee of Oregon and Washington at a meeting of that body in Portland on August 21. This committee, of which E. A. Simms of the Washington Fish Commission is chairman, was the outgrowth of the hearing in May attended by representatives of both the fish and power industries which was held in connection with the application of the Washington Irrigation & Development Company to construct a 90-ft. dam across the Columbia River at Priest Rapids. (See ELECTRICAL WORLD, May 24, page 1102.)

This project and others involving high dams across salmon-spawning rivers are being held up until it shall be satisfactorily demonstrated that the fish can without injury be passed over such dams. As reported in the ELECTRICAL WORLD for August 2 (page 232) and August 16 (page 332), however, the Federal Power Commission has granted a preliminary permit for a development on the Klamath River in California over the protests of the California Fish Commission. It is maintained that the Chinook and other kinds of salmon cannot negotiate an ordinary fishway of greater elevation than 40 ft., so that the committee appointed to carry on the experiments is contemplating some form of elevator or escalator.

PROBLEM HAS TWO PHASES

The first experiment, which will be under the supervision of John N. Cobb, director of the College of Fisheries of the University of Washington and executive secretary of the committee, will be conducted at the Condit dam of the Northwestern Electric Company on the White Salmon River in Washington, a tributary to the Columbia. This dam, which is 125 ft. high, was chosen because of a fall run of Chinook salmon occurring in the White Salmon between September 15 and October 15 and because there is a ledge half way to the top from which it will be convenient to work in placing the temporary elevator framework. The Link-Belt, Meese, Gottfried Company, Seattle, has submitted a design of a one-basket conveyor which will be tried out.

The second phase of the experiment will be to see if the young fish can pass safely over the larger dams on their way down stream from the spawning grounds to the sea. Professor Cobb already has made experiments in passing them through a small turbine, and he now proposes to try sending them over the Snoqualmie Falls, where the result of a shear drop can be tested. He will also experiment in a like manner at some dam having an apron sloping down stream so as to ascertain how the fish take to this kind of a drop.

The results of the experiments will be watched with interest by both the fishing and power interests. Harmony between these interests is evident, and the preliminary expense of the experiments, amounting to $5,000, has been borne equally by both. Several of the larger power companies of the Northwest have subscribed their share of the $2,500 to be advanced by the power interests, and the fish commissions of the two states have subscribed the balance.

The committee in charge of the experiments embraces, besides Messrs. Simms and Cobb, J. E. Yates, assistant engineer Pacific Power & Light Company, Portland; W. D. Shannon, general superintendent Stone & Webster, Seattle, and Carl D. Shoemaker, Fish Commissioner of Oregon.

Hetch Hetchy Water Bond Election Set

The San Francisco Board of Supervisors has passed an ordinance calling for a special election on October 7, 1924, at which time the voters of the city will be asked to authorize the issuance of $10,000,000 in bonds to carry on the construction of the Hetch Hetchy water system of the city. This bond issue will provide no funds for the purchase or construction of a municipal electrical distribution system for Hetch Hetchy power, it having been decided to postpone that matter until a later date when the Railroad Commission shall have fixed a valuation for condemnation proceedings on the distribution systems of the Pacific Gas & Electric Company and the Great Western Power Company within the city of San Francisco. The commission has been authorized to make such valuations and work has been under way for some time. Approximately $25,000 has already been spent, and about $100,000 more will be required to complete the work. It is not expected that the findings of the commission will be handed in before the end of another ten months.

Indiana Electric Utilities Are Expending Fifty Millions

Indiana public utilities, according to officers of the Indiana Public Utility Association, are in the midst of an extension and improvement campaign which will result in the total expenditure of $100,000,000, much of which will be paid out before the end of 1924. This estimate is based on an informal canvass made by the association among its members. This canvass revealed the fact that the electrical industry is expending half of this amount. This included the work being done by the Indiana & Michigan Electric Company in South Bend and the St. Joseph Valley, by the Northern Indiana Gas & Electric Company and the Calumet Electric Company in the Calumet region, and by the Southern Indiana Gas & Electric Company in and around Evansville.

The expenditure also covers the large projects of the Interstate Public Service Company, including its new water-power development on the Tippecanoe River near Monticello, with necessary high-tension lines, and the transmission systems being erected by the Indiana Electric Corporation to connect its various properties and customers with its new power station on the Wabash River near Terre Haute. It also covers the work being done by the Indianapolis Light & Heat Company in the Indianapolis industrial district.

Electric-Steam Generator Saves Much Fuel

Coal savings estimated at 3,000 tons per year are looked for from the installation of an electric-steam generator recently ordered by the St. Croix Paper Company at Woodland, Me. Improved power factor and the utilization of spring and fall high water are expected to result from other up-to-date electrical machinery now being installed.

The hydro-electric plant of this company is on the St. Croix River and is 12 miles from the company's mill. A General Electric 3,360-kw., 2,400-volt vertical waterwheel generator is now being installed to be used as a spare unit and to permit the utilization of high water in the spring and fall for the generation of excess power. This excess power may be used either for the making of wood pulp or for running the electric-steam generator. Wood pulp made in this manner during the flood season will be stored away as dry-pulp laps and be made into paper during the dry summer and fall months.

Officials of the St. Croix Company and General Electric engineers estimate that the new generator may produce as high as 15,000,000 kw.-hr. excess power at high-water periods with a normal rainfall. By putting this power into the electric-steam generator they expect a saving of approximately 3,000 tons of coal a year. The steam generator is to be installed in the boiler house and will be piped into the main steam line, supplementing the coal-fired boilers. Steam necessary to heat the mills on Sundays and holidays, when the motor load is shut off will come from the electric-steam generator, and the load curve of the mill will be ironed out by having the steam generator take up the variations in electrical load on the mill from time to time.

An 1,800-hp., 2,200-volt synchronous grinder motor, to be directly coupled to pulp grinders, is also being installed. Present wood grinders at the paper mill are part motor-driven and part waterwheel-driven and are of the pocket type. The new motor will also drive pocket grinders, but will be so arranged that magazine grinders may be installed later. In addition to the necessary switchboard equipment, a 6,000-kva. transformer has been ordered to step down the voltage from 33,000 to 6,600 for use in the electric-steam generator. The electrical machinery already installed, as well as the new equipment, was made by the General Electric Company.

Three definite results are expected by the St. Croix officials: Power-factor correction by the synchronous grinder motor, the utilization of otherwise waste energy by working up raw material in advance of requirements, and the substitution of a certain amount of electrically generated steam for the steam ordinarily produced by burning coal.

Hoover Calls Third National Radio Conference

A national conference for voluntary regulation of radio has been called by Secretary of Commerce Hoover to be held in Washington beginning September 30 and continuing as long as is necessary. Two previous conferences of this character have been held, one in February, 1922, and the other in March, 1923, both generally attended by individuals and representatives of organizations interested in the subject. It will be recalled that Congress again adjourned last June without passing the control bill.

Experience has fairly well demonstrated, Secretary Hoover says, that even the most elaborate tube receiving sets cannot be depended upon consistently to receive distant broadcasting; therefore the future of radio as a service rather than a fad appears to be in purely local broadcasting, which, in order to be of full value, means interconnection of stations. Interconnection will therefore be a main topic of the conference.

Proposed legislation to vest in some governmental agency greater authority over sending stations will also be discussed, and among other topics announced are the revision of the present frequency or wave-length allocations, to reduce interference; use of high frequencies or short waves; classification of broadcasting stations, with possible discontinuance of class C stations; limitation of power, division of time and zoning of broadcasting stations; means for distinguishing the identity of amateur calls from foreign countries; interference by electrical devices other than radio transmitting stations, and relations between government and commercial services.

Michigan Electric Light Association Convention Plan

Meeting at the Hotel Statler, Detroit, from Tuesday to Thursday of next week, September 9-11, the Michigan Electric Light Association will follow this program:

TUESDAY, SEPTEMBER 9

Evening.—Joint meeting with Michigan Gas Association under auspices of the Michigan Committee on Public Utility Information; director's report, Alfred Fischer, followed by five-minute speeches from the members of the committee; address on advertising by Harry D. Robbins, director Advertising Clubs of the World.

WEDNESDAY, SEPTEMBER 10

Morning.—President's address, R. T. Duncan; paper, "Advertising by Central Stations," D. Mackie, Consumers Power Company; symposium on sales of electrical appliances by W. H. Burke, Houghton County Electric Light Company; J. C. Burton, Detroit Edison Company; H. W. Courville, Consumers Power Company; E. Horry, Edison Sault Electric Company, and B. E. Waltz, Michigan United Light & Power Company.

Afternoon.—Inspection trip to the Connors Creek power house of the Detroit Edison Company and to the Dodge Brothers' motor-car factory.

Evening.—Banquet; speaker, Rev. M. S. Rice.

THURSDAY, SEPTEMBER 11

Morning.—Address, "Valuation," F. A. Newton, Hodenpyl, Hardy & Company; symposium on sales of securities to customers by A. W. Baldwin, Detroit Edison Company; H. H. Koelbel, Consumers Power Company, and P. B. Simons, Michigan Gas & Electric Company; discussion on the "Better Home Lighting" activity; election of officers.

A golf tournament will be held on Thursday afternoon.

Electragists' Program for Fall Convention

For the thirty-fourth annual convention of the contractor-dealer body now known as the Association of Electragists International, to be held at West Baden Springs, Ind., from September 29 to October 4, the program will include the following reports and addresses:

TUESDAY, SEPTEMBER 30

Morning.—President's address; reports of code and legislation committees; "Uniform Electrical Ordinance," T. E. Barum; "'Red Seal' Plan," W. L. Goodwin; "Your Responsibility as an Electragist," Albert Wahle.

Evening.—Union-shop and open-shop section meetings.

WEDNESDAY, OCTOBER 1

Morning.—Report on merchandising policies; address, John F. Gilchrist; "Wholesale Distribution," W. R. Horstein; "Distribution of Motors," A. H. Timmerman; "Distribution of Appliances," George E. Parvis; discussion, "Can the contractor make a profit as a dealer?"

Evening.—Business class—financing, credits, buying, selling and collecting.

THURSDAY, OCTOBER 2

Morning.—"Cost Studies and Estimating," A. L. Abbott; "Handling the Big Job," O. F. Wadleigh and Allan Coggeshall; "Managing the Motor Repair Shop," George P. Svendsen; "Old-House Wiring on a Big Scale," Frank Libbon; "Standard Accounting Plan in Milwaukee," W. J. Schnelke.

Evening.—Business class on organizing and handling business.

FRIDAY, OCTOBER 3

Morning.—Report of standardization committee; address, S. L. Nicholson; "Lighting Educational Committee," J. E. Davidson; "Tendency Toward Monopolistic Insurance," Lyndon T. Block.

Evening.—Awarding of prizes.

There will be meetings of the executive committe on Monday and Saturday. The afternoons will be devoted to sports.

Tentative Program of the Fall Convention of the A. I. E. E. at Pasadena, Cal.

MONDAY, OCTOBER 13

Morning.—President's address, Farley Osgood; transmission session (dealing particularly with corona): "The Hysteresis Character of Corona Formation," Prof. H. J. Ryan and H. H. Henline, Stanford University; "A High-Voltage Wattmeter," Philip C. Clark and Chas. E. Miller, Stanford University; "Power Measurements at High Voltages and Low Power Factors," J. S. Carroll, T. F. Peterson and G. R. Stray, Stanford University.

Afternoon.—"Corona Losses from Large Cables," J. C. Clark, Stanford University, and F. F. Evenson, Benson Lumber Company; "Corona-Loss Tests on 202-Mile, 220-Kv. Transmission Line," Roy Wilkins, Pacific Gas & Electric Company. *Evening.*—Annual dinner.

TUESDAY, OCTOBER 14

Morning.—Transmission session; "The Corona as Lightning Arrester," John B. Whitehead, Johns Hopkins University; "Corona Losses Between Wires at High Voltage," C. Francis Harding, Purdue University; "Lightning," E. E. F. Creighton, General Electric Company; "Lightning and Other Transients on Transmission Lines," F. W. Peek, Jr., General Electric Company.

Afternoon.—Transmission and interconnection session: "Transmission at 220 Kv. on Southern California Edison System" (composite paper by members of Southern California Edison Company): Section 1, "Description of System and Operating Experience," H. Michener; Section 2, "Protective System," E. R. Stauffacher; Section 3, "Economic Studies in Transmission-Line Design," W. D. Shaw and C. B. Carlson; Section 4, "Vibration of Conductors and Overhead Ground Wires," J. M. Gaylord; Section 5, "Location and Right-of-Way," V. D. Elliott. "Interconnection of Power Systems in the Southeastern States," W. E. Mitchell, Alabama Power Company.

Evening.—Addresses by prominent executives and engineers.

WEDNESDAY, OCTOBER 15

Morning.—Machinery and transmission session: "Large Steam-Turbine Generators," W. J. Foster, E. H. Freiburghouse and M. A. Savage, General Electric Company; "Heating of Large Aluminum Transmission-Line Cables," R. J. C. Wood, Southern California Edison Company; "High-Voltage Line Insulation," A. O. Austin, Ohio Insulator Company; "A New Type of High-Tension Insulator," H. B. Smith, Worcester Polytechnic Institute.

Afternoon.—Research and electrophysics session (the eight papers following are by members of the Norman Bridge Laboratory of Physics, California Institute of Technology): "Influence of Temperature on Photo-Electric Emission," R. C. Burt; "Collisions of the Second Kind," Stanislaw Loria; "Electric Currents Due to Fields Alone," S. S. MacKeown; "Electronic Orbits in Atoms," R. A. Millikan and I. S. Bowen; "Transfer of Radiant Energy to Free Electrons," E. C. Watson; "Electronic Emission Under the Bombardment of Positive Ions," A. L. Klein; "A Magnetic Lens," W. R. Smyth; "A Complex-Quantity Slide Rule," J. W. M. Du Mond. "A Method of Obtaining Steady High-Voltage Direct Current from a Thermionic Rectifier Without a Filter," F. W. Maxstadt, California Institute of Technology.

Evening.—Dinner at California Institute of Technology; lecture by Dr. R. A. Millikan.

THURSDAY, OCTOBER 16

Morning and Afternoon.—Utilization session: "Electricity in the Lumber Industry," J. L. Wright, General Electric Company; "Electricity in Mines," F. L. Stone, General Electric Company; "Contribution of Electricity to the Steel Industry," K. A. Pauly, General Electric Company; "Electrical Applications to Irrigation Pumping," R. H. Gates, Southern California Edison Company; "Electrical Equipment of Consolidated Lining and Smelting Company's Zinc Plant," R. H. N. Lockyer, West Kootenay Power Company; "Electrometallurgical Applications," J. L. M. Yardley, Westinghouse Electric & Manufacturing Company.

Afternoon.—Trip to Mount Wilson.

Evening.—Entertainment program.

FRIDAY, OCTOBER 17

Morning.—Telephony and illumination session: "Street Lighting a Municipal Problem," R. D. Whitney, Syracuse University and Syracuse Bureau of Gas and Electricity; "Guided and Radiated Energy in Wire Transmission," J. R. Carson, American Telephone & Telegraph Company; "Telephone Transmission Maintenance Practices," W. H. Harden, American Telephone & Telegraph Company; "Telephonic Line Balance," L. P. Ferris and R. G. McCurdy, American Telephone & Telegraph Company.

Afternoon.—Golf and tennis tournaments and other sports.

Evening.—Banquet: reminiscences by Institute pioneers.

SATURDAY, OCTOBER 18

Trips to interesting points.

Brief News Notes

Huntington, Mass., Goes from Direct to Alternating Current.—The Huntington (Mass.) Electric Light Company has just changed over its lighting system from 220 volts direct current to 110 volts alternating current. The direct-current system had been in operation since December, 1904. The company's primary transmission is now at 2,300 volts, 60 cycles. The change involved an entirely new lighting installation with 60-cp. lamps in series.

Water-Power Plant Near Benton, Ind., Projected. — The proposed dam and water-power plant of the Interstate Public Service Company on the Elkhart River, a mile above Benton, Ind., has been declared a public utility by the Indiana Public Service Commission. As a result the company has the right to proceed with condemnation suits. Hitherto its plans have been obstructed because of the high prices at which some property owners at the proposed site hold their land.

Southern California Edison Gets State Permits for Hydro Development.—The California Division of Water Rights has issued eighteen permits to the Southern California Edison Company covering hydro-electric development in nearly the entire San Joaquin River watershed above the 1,000-ft. altitude. These permits are in line with the company's extensive program of additional water-power stations, the entire completion of which will require a continuous building program extending over eighteen years and involving an expenditure of approximately two hundred million dollars.

Everett, Wash., Opposes Hydro-Electric Plant on Sultan River.—Claiming that it needs all the waters of the Sultan River for domestic purposes, the city of Everett, Wash., is protesting against any extension of the permit for a hydro-electric plant on that river granted by the Federal Power Commission to the Sound Electric Company. The City Council contends that the Sound Power Company has not prosecuted any work on the Sultan River since the granting of the temporary permit two years ago.

Northern States Company Buys Oldest Minneapolis Flour Mill.—The Cataract Mill, the oldest flour mill in Minneapolis, has been purchased by the Northern States Power Company, together with the entire property of the milling company, including water-power leases at St. Anthony Falls, rated at 500 hp. The purchase of the mill property is incidental only to the acquisition of the water-power lease for public utility service. The old mill, erected in 1859, was the first complete flour-manufacturing plant on the west bank of the Mississippi and was the forerunner of the present group of large mills in that district.

Yakima Valley Towns Seek Lower Rates. — A complaint looking toward readjustment of rates charged by the Pacific Power & Light Company, Portland, Ore., in the Yakima-Walla Walla (Wash.) district has been filed against the utility by the Department of Public Works at Olympia, Wash. This action followed the receipt of a formal complaint from the city of Walla Walla. After investigation by rate experts and engineers a public hearing will be called.

Another Small New York State Company Asks Leave to Sell Out.—The Seely Electric Company of Spencer, Tioga County, N. Y., which supplies electricity in the town and village of Spencer, the town and village of Van Etten and the village of Candor, has petitioned the Public Service Commission asking for the transfer of its franchises, works and system to the New York State Gas & Electric Corporation of Ithaca. The company has an isolated steam plant of limited capacity, which will soon be reached.

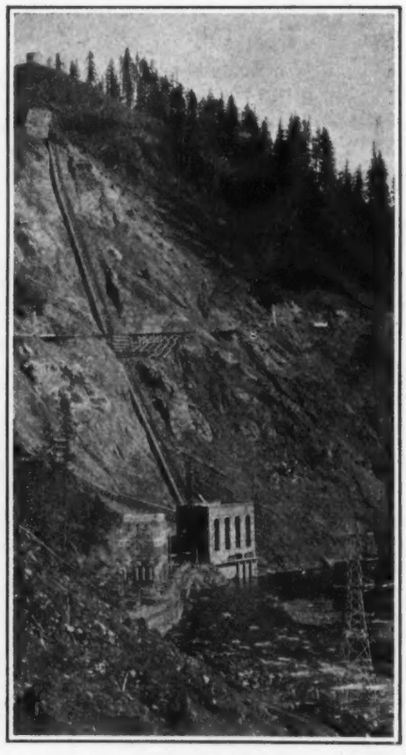
Loveland (Col.) Municipal Authorities' Right to Build Plant Again Sustained.—A temporary injunction brought by the Public Utilities Commission to restrain the city of Loveland, Col., from continuing its work on a municipal plant was denied by the District Court at Fort Collins on August 26. It is not known whether the matter will now be taken into the federal courts or whether the differences between the municipality and the Public Service Company of Colorado will be settled by arbitration. Disposition of the distribution system owned and operated by the latter company is the principal subject of concern.

Chickasha Gas & Electric Company Growing Rapidly.—The Chickasha Gas & Electric Company, which is a subsidiary of the Public Service Company of Oklahoma, is making improvements to be completed this year which will cost $300,000. These include high-tension lines to six small towns of Caddo and Grady Counties, giving these towns twenty-four-hour electric service. The company has also taken over two municipal plants, at Cement and Minco, and is spending $70,000 in rebuilding a dam at its hydro-electric plant on the Washita. It has erected a line from the Chickasha plant to El Reno, connecting with the Oklahoma Gas & Electric Company's line at that point.

Colorado Springs Makes New Offer to Company.—The Colorado Springs (Col.) City Council has made an offer of $800,000 to the Colorado Springs Light, Heat & Power Company for all of its property and rights outside the corporate limits of the municipality. This follows closely on the track of the agreement of the company to sell to the city its plant and distribution system within the city limits for $600,000. (See ELECTRICAL WORLD for August 16, page 329.) In the meantime it is understood that the company is planning on concluding its commercial operations as soon as possible, regardless of the legal difficulties which yet remain to be settled before the city can take title to the system as approved at a special election several months ago.

Expansion of Carolina Power & Light Company.—The Carolina Power & Light Company of Raleigh, N. C., has purchased and taken over operation of the Smitherman Power Company and the Deep River Power & Light Company, two utilities of southern North Carolina, according to announcement from the main offices of the company in Raleigh. The Smitherman Power Company, with headquarters at Troy, N. C., has been serving the towns of Troy, Biscoe, Candor, Jackson Springs and Ellerbe. The Deep River Power & Light Company has served the town of Pittsboro at wholesale and Ramseur and Franklinville. The Smitherman company has two small water-power developments on Little River and some steam power, while the Deep River concern owns a hydro-electric plant at Locksville. Connections are being made with the main transmission lines of the Carolina company. The Carolina company will also take over the municipal plants at Pittsboro and Ellerbe, it is stated. The Carolina company recently acquired the Sandhill Power Company, in the same general territory as these latest acquisitions.

Oak Grove Station of Portland Electric Power Company



The illustration shows the new Oak Grove power house of the Portland (Ore.) Electric Power Company, described in the ELECTRICAL WORLD for August 16, page 330. At the top of the picture appears Cripple Creek Knoll, with the surge tank, 31 ft. in diameter, extending above it. The penstock is 1,360 ft. long.

Southern Cities Power Buys Columbia (Tenn.) Plant.—The Southern Cities Power Company of Chattanooga, Tenn., has announced the purchase of the Columbia (Tenn.) Water & Light Company from Charles E. Bigelow of New York. Though the contract is signed, details are not yet worked out. No price is stated, but the value put on the plant by the seller is said to be about $500,000. The Southern Cities Power Company is a subsidiary of the Southern Cities Utilities Company of Chattanooga, which controls eight or ten utility companies and owns water rights capable of affording 35,000 hp. when developed. A steady increase in the demand made on the Columbia plant for power is reported.

Electric Light Used to Save Peaches from Moths.—In southern New Jersey the owner of one of the largest peach orchards in the state, covering 60 acres, has called the electric light into requisition to save his crop from the attacks of moths. One hundred and twenty-five lamps are hung in the orchard about four feet from the ground, under which are shallow pans filed with kerosene into which the dazzled insects attracted by the light fall and are killed. The method is held by the fruit grower to give promise of efficacy, though he is in some doubt whether the brilliantly lighted orchard, which is on an elevation and looks from a distance like a pleasure park, does not attract more than its share of the pests.

Plans of Binghamton (N. Y.) Light, Heat & Power Company.—The Binghamton (N. Y.) Light, Heat & Power Company has made application to the Public Service Commission for authority to merge with itself the Owego Light & Power Company, the capital stock of which it recently acquired. The Binghamton company also asks permission to construct four new transmission lines in Broome, Chenango, Cortland and Tioga Counties. These lines will transmit energy from the main power station at Crocker Island, Broome County, to the territory to be served and will be designated as the Greene-Smithville line, the Cortland line, the Cincinnatus line and the Newark Valley-Berkshire-Richford line. They will all be for 33,000-volt transmission except the Greene-Smithville line, which will be built for 13,000 volts.

Litigation Over Coosawattee Sites Ends, with Big Plants Predicted.—Three big power plants are in prospect along the Coosawattee River as the result of a settlement of long litigation between the N. P. Pratt interests and the Washington Land Company, said to be controlled by the Georgia Railway & Power Company. According to the terms of the settlement, which was made out of court, the Pratt interests will now have undisputed title to lands for about 15 miles along the Coosawattee River, while the Georgia Railway & Power Company will take possession of seven miles on the river just below this. Mr. Pratt, it is said, contemplates the construction of one power plant, while the Georgia Railway & Power Company is expected to construct two. If the Coosawattee developments are made in accordance with predictions, they will involve a total cost of $18,000,000 and provide for the eventual development of 120,000 hp., to be distributed over a wide area in north Georgia.

Northeastern Iowa Power Company Adds to Its Territory.—The Northeastern Iowa Power Company, with headquarters in Claremont, which, as already announced, recently purchased the Consumers' Power Company of Osage, the Calmar Electric Company and the People's Power Company of Readlyn, has also acquired a controlling interest in the People's Public Service Company of Elkader, serving nine towns. The Northeastern Iowa Power Company owns three undeveloped water-power sites, one of which, at Mitchell, Iowa, will, it is said, be developed at once. The population of the territory served, in northeastern Iowa and Mower County, Minn., is approximately 100,000.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Association of Edison Illuminating Companies—Griswold Hotel, New London, Conn., Sept. 8-12. P. S. Millar, 80th St. and East End Ave., New York.

Michigan Electric Light Association—Hotel Statler, Detroit, Sept. 9-11. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

New England Division, N. E. L. A.—Hotel Wentworth, Portsmouth, N. H., Sept. 10-13. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. O. A. Weller, 900 15th St., Denver.

Colorado Public Service Association—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. J. F. Greenawalt, Mountain States Telephone & Telegraph Company, Denver.

Southeastern Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Association of Iron and Steel Electrical Engineers—Duquesne Garden, Pittsburgh, Sept. 15-20. J. F. Kelly, 513 Empire Building, Pittsburgh.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 24-27. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Electrical Supply Jobbers' Association, Pacific Division—Del Monte (Del Monte Lodge, Pebble Beach), Cal., Sept. 25-27. Albert H. Elliot, 502 Flatiron Bldg., San Francisco.

Safety Congress, National Safety Council—Hotels Brown and Seelbach, Louisville, September 29-October 3.

Association of Electragists International—West Baden Springs, Ind. Sept. 29-Oct. 4. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Hotel Fuller, Detroit, Oct. 2-4. Colin G. Fink, Columbia University, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 6-10. J. W. Welsh, 8 West 40th St., New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 6-7. C. H. B. Chapin, Grand Central Terminal, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Pasadena, Cal., Oct. 13-17. F. L. Hutchinson, 33 West 39th St., New York.

International Association of Municipal Electricians—Partridge Inn, Atlanta, Oct. 14-17. W. R. Arbuckle, Bayonne, N. J.

Electric Power Club—Greenbriar Hotel, White Sulphur Springs, W. Va., Oct. 20-23. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Kansas Public Service Association—Broadview Hotel, Emporia, Kan., Oct. 24-25. R. T. Smalley, Kansas Electric Power Co., Emporia.

Illuminating Engineering Society, Briarcliff Manor, N. Y., Oct. 27-31. N. D. Macdonald, 29 West 39th St., New York.

Spectacular Lighting at Two Fairs.—Spectacular lighting displays that will recall the impressive spectacles at the San Francisco and Rio de Janiero expositions are to be made at the State Fair at Syracuse, N. Y., on September 8-13 and the Agricultural Fair at Brockton, Mass., on September 30-October 4. The two displays will be alike in some respects, although each will have its special treatment. They include thousands of "Novagem" jewels, batteries of powerful searchlights totaling nearly a quarter of a billion candlepower in each case, unique designs and the use of synchronized fireworks and smoke effects. At Syracuse a structure representing a natural limestone cavern will be built within the racecourse. It will be 157 ft. wide and 90 ft. high at its highest point. Nine jeweled "stalagmites" will be its most beautiful feature. The display at Brockton will not be so massive in appearance, but the more delicate treatment will be fully as impressive in its own way. This display will be 120 ft. wide and 75 ft. high and will face the spacious grand stand. The installations will be under the direction of W. D'Arcy Ryan, director of the General Electric illuminating engineering laboratory.

Columbia University Approves Modification of Engineering School Requirements.—The council and trustees of Columbia University, New York, have approved a modification of the admission requirements to the engineering schools which provide that a student entering Columbia College with a good scientific preparation may, in a prescribed course, be prepared for admission to the engineering schools in two years and one summer session. Hitherto the shortest possible time for completing the pre-engineering preparation has been three years of college work. The specified requirements in the scientific and general subjects remain just as before, and the admission requirements for students coming from other institutions than Columbia College are not changed. Students taking the regular three-year pre-engineering course exercise the professional option in Columbia College and receive the A.B. degree on the completion of the first dents taking the shortened pre-engi- year in the Engineering School. Stu- neering course will not be eligible for the A.B. degree under the professional option, and the faculty has therefore voted to award the B.S. degree to these students at the end of their fourth year; that is, at the end of the second year of the regular three-year professional course in engineering. Thus a student taking this course will not be penalized by having to wait five years before receiving his first degree.

Men of the Industry

E. B. Stason of Sioux City, Iowa, has been appointed instructor in public utility law in the law school of the University of Michigan.

J. M. Robinson, head of the firm of J. M. Robinson Sons of St. John, New Brunswick, has been elected a director of the Lower St. Lawrence Power Company, Rimouski, Quebec.

Harold V. Bozell, editor of the ELECTRICAL WORLD, returned to New York on Friday, August 29, aboard the Cunard liner *Berengaria* after a tour of Europe covering ten weeks. While abroad Mr. Bozell attended the World Power Conference held in London early in July, reports of which from his pen have appeared in recent numbers of the ELECTRICAL WORLD. He visited Switzerland, Poland, Czechoslovakia, Germany, France and Spain, making a study of electrical conditions in these countries.

W. F. Raber, formerly vice-president and general manager of the Southern Colorado Power Company, Pueblo, has been made general manager of the San Diego (Cal.) Gas & Electric Company.

F. W. Clark, for thirteen years on the engineering staff of the Hydro-Electric Power Commission of Ontario and for some time assistant chief field engineer on the Queenston-Chippawa development, has been placed in charge of power surveys of the Ottawa River for the commission.

Harold E. Howell, a member of the faculty of the electrical engineering department, Iowa State College, Ames, has been employed by the Traer (Iowa) Water and Light Commission as manager of the municipal electric power and steam-heating plant, succeeding B. W. Berry, who recently resigned.

G. V. Lonnecker of Chicago has been appointed chief engineer of the Citizens' Gas & Electric Company, Waterloo, Iowa, to succeed C. H. Phillips, who served in that capacity for the past three years. Mr. Lonnecker was formerly associated with the General Electric Company in Chicago.

W. F. Grimes, formerly connected with the bureau of engineering of the United States Navy Department in Washington, has recently joined the Los Angeles office of the Westinghouse Electric & Manufacturing Company in the meter engineering department of the central-station division.

A. C. D. Blanchard has recently been appointed hydraulic engineer of the New Brunswick Power Commission. Mr. Blanchard has just terminated a long and successful engagement as chief field engineer on the Queenston-Chippawa power development of the Hydro-Electric Power Commission of Ontario.

J. M. Brown, superintendent of the electric department of the Oklahoma Gas & Electric Company, who has been working as construction superintendent for the Byllesby Engineering & Management Corporation in the construction of the Harrah high line, has completed his work and has returned to take up his duties in Oklahoma City, where he is superintendent of electric operation, distribution and transmission. Mr. Brown has been in the employ of the Oklahoma Gas & Electric Company for twenty-two years.

R. M. Campbell Joins Sangamo Electric Company

Reginald M. Campbell, well known in the electric light and power and electric railway fields, has been appointed special representative of the Sangamo Electric Company of Springfield, Ill., to co-operate particularly with the central stations and other public utilities of the country. For a long period of years Mr. Campbell was associated with the Ohio Brass Company, severing his connection with that organization to affiliate himself with the Habirshaw Electric Cable Company, with which he spent eight years. In the spring of 1922 he entered the employ of the American Copper Products Company, one of the largest producers of copper products in the country, as special representative, resigning from that position last year. Mr. Campbell's headquarters will be at the New York office of the Sangamo company.

R. M. CAMPBELL

E. F. Stone, since 1909 superintendent of the light, power and sales department of the Southern Colorado Power Company, Pueblo, and its predecessors, has been promoted to the office of assistant general manager. Mr. Stone has been active in public utility operation for twenty-one years.

A. S. Glasgow has been appointed assistant superintendent of electric distribution of the San Diego Consolidated Gas & Electric Company to succeed Emory Sherwin, recently made assistant superintendent of electric production. Mr. Glasgow was formerly district agent of the company at Oceanside and more recently was assistant to Mr. Sherwin.

Walter C. Allen, executive secretary to the Public Utilities Commission, Washington, D. C., has resigned to take a position with the Welsbach Street Lighting Company. Mr. Allen will have charge of the newly created electric lighting department, the Welsbach company up to the present time having specialized in street lighting by gas.

Alex Dow, president of the Detroit Edison Company, has recently been made an honorary member of the Electrical Extension Bureau of Detroit in recognition of his contributions during the past twenty-five years to the advancement of the electrical industry. A handsomely engraved and framed testimonial was presented to Mr. Dow, the first recipient of honorary membership in the bureau.

Karl Anton Piez, lighting sales engineer for Curtis Lighting, Inc., Chicago, was appointed manager of this organization's Boston office to fill the vacancy created by the death of R. B. Corby. Mr. Piez has been connected with the Curtis company since 1923 and before that time was in the lighting sales organization of the Columbia (Ohio) Railway, Power & Light Company.

Emory Sherwin, assistant superintendent of electric distribution and transmission of the San Diego (Cal.) Consolidated Gas & Electric Company for the past two years, has been made assistant superintendent of electric production. Mr. Sherwin is succeeding M. C. Wheyland, who is now indentified with the Northern States Power Company, Minneapolis.

Robert J. Graf, first vice-president and secretary of H. M. Byllesby & Company, has been appointed president of the San Diego (Cal.) Consolidated Gas & Electric Company to fill the vacancy caused by the transfer of H. H. Jones to the vice-presidency of the Northern States Power Company. Some details of Mr. Graf's career were printed in the May 24, 1924, issue of the ELECTRICAL WORLD at the time of his promotion to the office of first vice-president.

Obituary

Max Herskovitz president of the Peerless Light Company, Chicago, died on Sunday, August 10.

Bert W. Wattles, president of the Hot Springs (S. D.) Light & Power Company, died on August 17 in a hospital in that city. Mr. Wattles' death resulted from an attack of double pneumonia.

Charles Augusta Ross died at his home at Alpha, Ill., on August 18 after three weeks' critical illness. He had been in poor health since sustaining an attack of influenza two years ago. Mr. Ross was the manager of the plants of the Illinois Northern Utilities Company in Alpha, Woodhull, New Windsor and Rio. He was born February 29, 1876, at Keithsburg, Ill., and was educated there.

Financial and Corporate

Market Values Rally

Good Undertone Appears in Market for Stocks Despite Holiday Period

ALTHOUGH the listed markets at times turned distinctly dull as the Labor Day period approached and, until Germany's acceptance of the reparations plan was announced, were irregular, the unlisted market in power and light stocks held fairly strong. Business was dull in various departments, to be sure, but prices generally pursued an upward course. The passing of August this year brought no protracted declines in utilities, although that was the month when a reaction had been predicted confidently by some who had watched certain spectacular advances. While the utility bonds are in wide demand at about present levels, the more interesting developments still seem to occur among the equity issues.

The announcement of a new plan for stock financing by the Commonwealth Power Corporation, which is reviewed elsewhere in this issue, was the occasion for some selling of Commonwealth by those desiring to take profits. The stock before the announcement touched 110¾ and afterward sold down to 104, when another rally set in. American Water Works & Electric Company's stock on the big board, following the publication of the earnings statement, ran up several points again and touched a level about eighty points above its low for the year.

Issues which gained about ten points during the week, and which therefore must be set down as the banner stocks from the standpoint of market appreciation, were American Power & Light, American Public Utilities and National Power & Light. Close seconds were Virginia Power, which gained seven points, and Commonwealth Edison, which gained six. Alabama Traction, Light & Power, of which sizable blocks are held in London, has been rising gradually as a result of further accumulation on the part of London buyers and by buyers here who have been following the increasing earnings of the Alabama Power Company, its main subsidiary.

Labor Prosperous with High Wages

A study of the question of wages and cost of living for the past ten years made by the National Industrial Conference Board and covering twenty-three manufacturing industries, employing 700,000 persons on the average, indicates that wages have been advanced 127 per cent during the ten-year period and, taking into consideration the advance in the cost of living, that wage earners should be 27 per cent better off than they were in 1914.

The wage increases in some of the manufacturing industries include 122 per cent in the automobile industry, 141 per cent in the iron and steel industry, 158 per cent in rubber, 125 per cent in boots and shoes and 166 per cent in cotton mills. The length of the average working week has dropped more than five hours during the ten-year period.

Light and Power Companies Call Bonds for Redemption

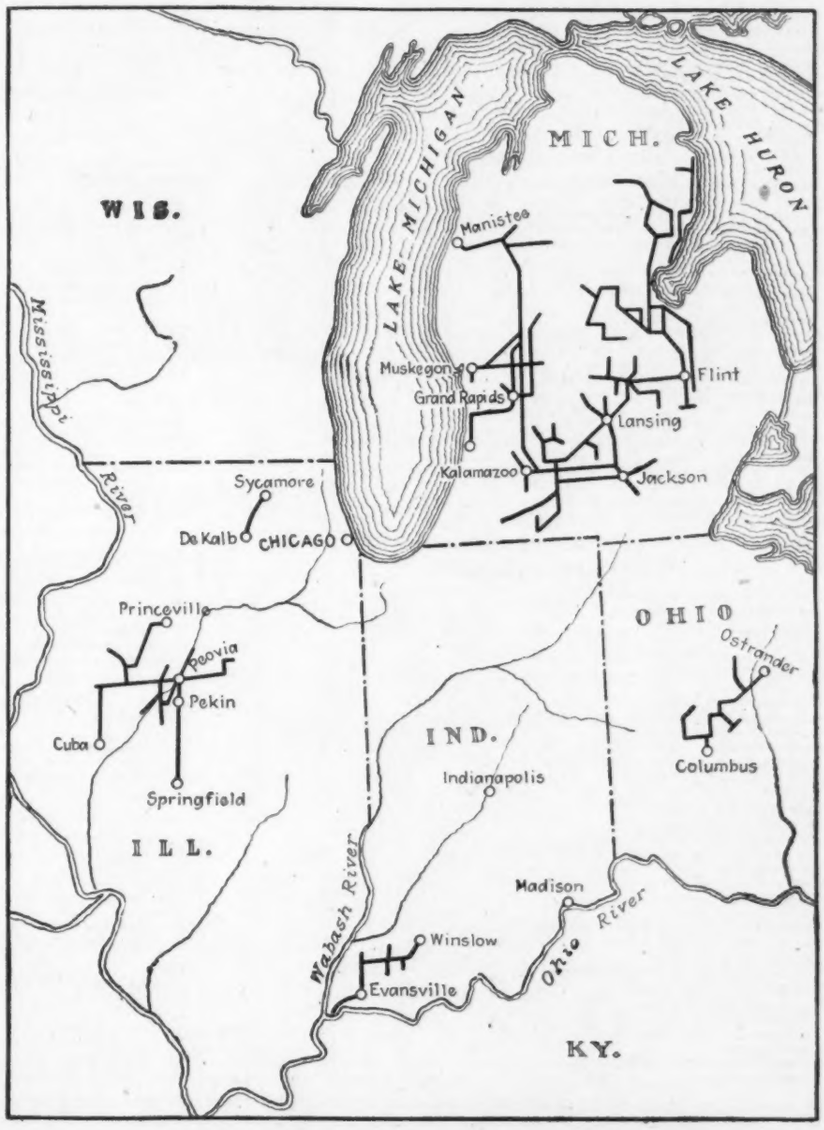
The Pennsylvania-Ohio Power & Light Company called for redemption on September 2 refunding 7½ per cent bonds totaling $12,805,200. Other light and power companies calling securities are the following: Choctaw Power & Light, $1,228,000 at 105; Idaho Power, $1,000,000 at 105; Luzerne County Gas & Electric, $1,000,000 at 105, and the Wisconsin Power, Light & Heat, $350,000 at 101.

Commonwealth Power Corporation's Plan

How a Utility That Was in the Doldrums Threw Out Its Tractions and, Having Grown Strong Under a Sound Structure, Now Takes Another Step Forward

BY PAUL WILLARD GARRETT

CONTRARY to opinion in some quarters, the Commonwealth Power Corporation's control extends to other important subsidiaries than the Consumers, Power Company. Indeed, in 1923, the other sources contributed 44 per cent of the gross earnings as against 56 per cent from Consumers. As the map shows, the present corporation has units in different states;



SYSTEM OF THE COMMONWEALTH POWER CORPORATION

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, Aug. 30	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	97	94	97½
Appalachian Power, 7 per cent	88½	85½	90
Arkansas Light & Power 7 per cent	90	81	93
Asheville Power & Light 7 per cent	96	96	99
Carolina Power & Light 7 per cent	98	95½	100
Central Illinois Public Service 6 per cent	84	84	87
Colorado Power 7 per cent	93	90	97
Connecticut Light & Power 7 per cent	99	99	102
Consumers' Power 6 per cent	89	85	93
Dayton Power & Light 6 per cent	84	84	90
Duquesne Light 7 per cent	106	103½	107½
Eastern Texas Electric 6 per cent	95	81	95
Empire District Electric 6 per cent	73	70	78
‡ Erie Lighting	*a* 28½	23½	30
Fort Worth Power & Light 7 per cent	97	97	100
Great Western Power 7 per cent	97	96	98
Illinois Northern Utilities 6 per cent	82	82	87
Illinois Power & Light 7 per cent	92½	84	95
Kansas Gas & Electric 7 per cent	93	92	97
Long Island Lighting 7 per cent	98	95	98
Minnesota Power & Light 6 per cent	87	78	87
Mississippi River Power 6 per cent	87	80	90
Nebraska Power 7 per cent	95	89	99
Niagara Falls Power 7 per cent—25	27½	26	29
Niagara, Lockport & Ont. Power 7 per cent	101	99½	104½
Northern States Power 7 per cent	94	91	97
Ohio Public Service 7 per cent	92	86	94½
Pacific Gas & Electric 6 per cent	90	85½	92½
Penn-Ohio Power & Light 7 per cent	90	84	96½
Pennsylvania Power & Light $7—no par	98½	93	99
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	*a* 38½	29¾	39⅝
Southern California Edison 8 per cent	115	112	119
Tennessee Electric Power, 6 per cent	78	71	81
Texas Power & Light 7 per cent	95	95	96½
Utah Power & Light 7 per cent	96	94	96½
Western States Gas & Electric 7 per cent	80	78	85
Yadkin River Power, 7 per cent	96	94	96½
Holding Companies			
American Gas & Electric 6 per cent—50	43½	41½	46
American Light & Traction	92	91	94½
American Power & Light 6 per cent	88½	84	91
American Public Service 7 per cent	89	84	92
American Public Utilities 7 per cent	81	73	85
American Water Works & Electric 6 per cent	*a* 91	66	99
Carolina Power & Light 7 per cent	97½	95½	99
Central Indiana Power 7 per cent	84	80	90
Cities Service 6 per cent	74	67	75
Commonwealth Power	*a* 78	72	82
Consolidated Gas 6 per cent—50	58½	51	59½
Continental Gas & Electric 7 per cent	85	69	90
Electric Bond & Share 6 per cent	100½	96½	103
General Gas & Electric—$8—no par	101	96	101½
Middle West Utilities 6 per cent	88	80	90
National Power & Light—$7—no par	91½	84	96½
North American 6 per cent—50	*a* 48½	43¾	50¼
Northern Ohio Electric	*a* 24	16	34
Public Service Corp. of N. J. 7 per cent	99	96½	100
Public Service Corp. of N. J. 8 per cent	107½	99¼	108½
Standard Gas & Electric 8 per cent—50	48¼	46½	49½
†United Gas Improvement—50	*a* 57	55½	58
United Light & Power—$6.50—no par	79½	75¼	80
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	32½	22½	34
Appalachian Power—no par	71½	66½	93
Arkansas Light & Power	60	22	63
Brooklyn Edison	*a* 117½	107½	117⅛
Buffalo General Electric	145	118	150
Carolina Power & Light	185	82½	195
Colorado Power	33	21	35
Commonwealth Edison	132	126	135
§Consolidated Gas, Electric Light & Power	*a* 118	113	118
Dayton Power & Light	133	70	133
Detroit Edison	*a* 109½	102¼	110½
|| Edison Electric Illuminating of Boston	*a* 187½	163½	190
*Kentucky Hydro-Electric	87½	85½	87½
Long Island Lighting	195	100	195
Mississippi River Power	32	18½	32½
Montana Power	66½	61½	71
Niagara Falls Power—no par	42	45	48
Niagara, Lockport & Ontario Power—no par	53	45	59
Northern Ohio Electric—no par	9	5	16
Northern States Power	99	92	106
North Texas Electric	61	58	84
Pacific Gas & Electric	95	90½	96½
‡Penn Central Light & Power—no par	59½	57	60
Pennsylvania Water & Power	107	98½	110
‡Philadelphia Electric—25	*a* 38½	29	39⅞
Public Service Co. of Northern Illinois	97	97	104
Puget Sound Power & Light	57	43½	61½
Southern California Edison	97	95	106
Tampa Electric	*a*162	134	162
Tennessee Electric Power—no par	40½	20	40½
Virginia Power	52	16	60
Virginia Railway & Power	*a* 68½	36	72¾
West Penn. Co.	*a* 89	47½	98

Companies	Bid Price Saturday, Aug. 30	Low 1924	High 1924
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	82	43½	82½
American Light & Traction	122	115	140½
American Power & Light (old)	398	220	408
American Power & Light (new)	40	34½	41½
American Public Utilities	95	35	97
American Water Works & Electric	*a*118	40	120
Carolina Power & Light—no par	195	103	195
Cities Service	143	140	155
Columbia Gas & Electric—no par	*a* 41½	33	42⅜
Commonwealth Power Corp.—no par	107	56	108
Consolidated Gas—no par	*a* 71⅜	60¼	72¾
Continental Gas & Electric	65½	49	72
Federal Light and Traction	79	70	83
General Gas & Electric	57	22	57
Lehigh Power Securities—no par	79	31	81½
Middle West Utilities—no par	61	41	62½
National Power & Light—no par	161	60	171
Philadelphia Co.—50	*a* 48⅝	42½	53½
Power Securities—no par	10½	4	14
Public Service Corp. of N. J.—no par	*a* 59⅝	39	59⅞
Standard Gas & Electric—no par	*a* 35¾	31½	37⅝
United Gas & Electric (Conn.)—no par	32	14	42
Utah Securities	*a* 33	16⅝	33
BONDS			
Operating Companies			
Adirondack Power & Light	6s 1950	103	97½ 103
Alabama Power	5s 1946	95	90½ 96
Appalachian Power	5s 1941	94	89 94½
Brooklyn Edison	5s 1949	100½	97½ 102½
	6s 1930	105½	102½ 106
	7s 1940	109	107 110½
Central Indiana Power	6s 1947	93½	88 95
Cleveland Electric Illuminating	5s 1939	100	98½ 100½
Commonwealth Edison	5s 1943	99½	95 100
	5s 1953	98	92 99½
§Consol. Gas, Elec. Lt. & Pwr.	4½s 1935	94½	91½ 95
	6s 1949	104½	101⅛ 105
	6½s 1951	108½	107 108½
Consumers' Power	5s 1936	98½	94⅜ 99½
	5s 1952	*a* 90	87 92⅛
Detroit Edison	5s 1933	100	99½ 100⅛
Duquesne Light	6s 1949	*a*105½	103½ 106½
Great Western Power	5s 1946	94½	90½ 96
Kansas City Power & Light	5s 1952	*a* 93½	89 95⅝
Mississippi River Power	5s 1951	96½	92 97
Montana Power	5s 1943	*a* 97½	95 98
New England Power	5s 1951	98½	97 100
New York Edison	6½s 1941	*a*112½	109¾ 112¾
Niagara Falls Power	6s 1950	105	104 105½
Northern States Power	5s 1941	*a* 93½	89½ 94
	6s 1941	*a*103½	101 104
Ohio Power	7s 1951	106	103 106½
Pacific Gas & Electric	5s 1942	*a* 93	90¾ 95
Pennsylvania Water & Power	5s 1940	99	96 99½
‡Philadelphia Electric	5s 1966	102⅜	97 103½
	5½s 1947	*a*103½	99½ 103½
	6s 1941	*a*107½	103¾ 107½
Portland Electric Power	6s 1947	*a* 93½	89¾ 95½
Southern California Edison	5s 1939	98½	96 99
	6s 1944	102½	100 103½
Tennessee Electric Power	6s 1947	*a* 97⅜	93⅜ 98⅜
Texas Power & Light	5s 1937	95	91½ 95
Toledo Edison	7s 1941	*a*109	106 109
Utah Power & Light	5s 1944	*a* 91½	87½ 93½
Holding Companies			
Alabama Traction, Light & Power	5s 1962	80	65½ 82
American Gas & Electric	6s 2014	95	94 95⅜
American Power & Light	6s 2016	94	91 94½
Amer. Water Works & Electric	5s 1934	91½	84½ 94
Commonwealth Power	6s 1947	*a* 96½	87 96½
Consolidated Cities Lt., Pwr. & Tr.	5s 1962	73	64 74
Illinois Power & Light	6s 1953	99	95 100½
United Light & Railways	5s 1932	92½	87½ 93½
	6s 1953	95½	92 96
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing		100	90 100½
*National Carbon		122	112 125
Worthington Pump & Machinery (A)		*a* 78½	68 79¾
COMMON STOCKS			
Allis-Chalmers Manufacturing		*a* 65	41⅛ 66½
American Bosch Magneto—no par		*a* 29½	22½ 38⅜
Electric Storage Battery—no par		*a* 57½	50¼ 64
General Electric		*a* 275½	193½ 281
General Electric—10		*a* 11½	10½ 11½
*Hurley Machine—no par		*a* 55⅜	48 59½
†Wagner Electric		25½	20 34⅜
Westinghouse Electric & Manufacturing—50		*a* 64	55½ 65
Worthington Pump & Machinery		*a* 30½	23¼ 31⅜
BONDS			
Canada General Electric	6s 1942	105½	102⅜ 106⅜
General Electric	3½s 1942	83	80 83½
	5s 1952	*a* 104½	100 104½
Robbins & Myers	7s 1952	78	75½ 91½
†Wagner Electric Manufacturing	7s	100½	97 100½
Western Electric	5s 1944	*a* 98	96 98⅜
Westinghouse Electric & Mfg.	7s 1931	*a* 108½	106½ 109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡ Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Wednesday, September 3.

among these are the Central Illinois Light Company, the Illinois Power Company and the Illinois Electric Power Company in the State of Illinois, the Southern Indiana Gas & Electric Company in the State of Indiana and the Ohio Edison Company in Ohio, not to mention miscellaneous properties.

The Consumers Power Company, which does a large share of the power and light business in the State of Michigan, is, of course, the largest and the most interesting member of the group. One of the things that make this subsidiary interesting, aside from the unusual possibilities for growth which it possesses, is the arrangement of its transmission lines. Interconnections now run north and south on each side of the state and across the lower end, forming a great horseshoe. Some day transmission lines will connect the two loose ends in the north, closing the horseshoe and rounding out a rather striking superpower system.

Things have gone well with Commonwealth under its new corporate structure, but the management believes that the corporation now is in position to take one more step forward, and the directors have accordingly proposed an ingenious plan of stock financing which the stockholders voted upon September 5, 1924. Consistent gains in earnings have raised the corporation's stock issues to an investment position within a relatively short time. Net earnings on the common stock, after liberal allowances for depreciation, already have reached an annual rate of about $13 per share, and by the end of the year doubtless will be higher on the same basis. The common shares have appreciated in market value from 50 earlier in the year to 110¾ recently. The directors properly feel that the time has come when the corporation may raise a portion of its capital through the flotation of stock. Stock financing has been a rather common thing in recent years on the part of operating companies, many of which have put on customer-ownership campaigns.

Commonwealth Power Corporation now has outstanding $24,000,000 of preferred stock of $100 par value and 200,000 shares of common stock of no par value. These, furthermore, represent the total authorized amounts. The directors propose that the authorized amount of preferred stock be increased by 60,000 shares, or $6,000,000, and the authorized amount of common by 100,000 shares. Only a portion of the additional authorized stock actually would be issued at the present time, probably an additional 30,000 shares, or $3,000,000, of preferred and 10,000 shares of common.

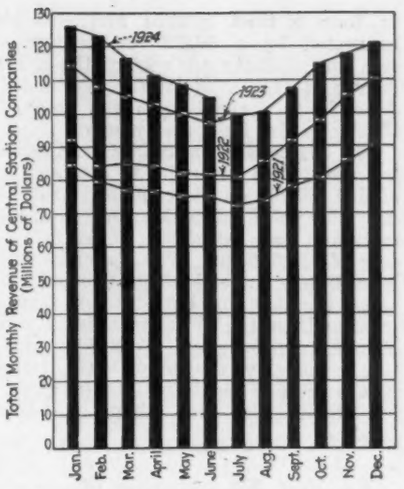
Under the proposed plan holders of common stock will be allowed to purchase blocks of three shares of preferred and one of common "for not less than $315 for each block." Considering that the present price of the preferred stock is 79 in the open market and the common around 108, such rights may have a substantial value. In addition, each block will carry negotiable rights to purchase at any time on or before November 1, 1926, three additional shares of common stock at $100 a share.

There are sound reasons why the announcement of a probable increase in the number of Commonwealth Power Corporation shares has hurt the stock relatively little in the market and why in the long run the plan will be likely to make the stock more valuable: (1) The new money will be used in part to purchase additional stock of subsidiary companies, an investment which the parent already has demonstrated is profitable. (2) It will be used in part also to retire indebtedness, thus bringing the preferred and common stock nearer to the properties. (3) The present stock will receive valuable rights. (4) Earnings per share as things now stand will be large even on the increased amounts of stock, and earnings are growing persistently. (5) The subsidiaries serve rich territories where great growth far into the future seems definitely assured. (6) There are large reserves for the development of additional power. (7) There has been no indication that the four-dollar dividend now being paid represents a permanent rate, and the likelihood is that it will be increased.

Energy Sales Rise Steadily

Regular monthly reports of central-station operations received by the ELECTRICAL WORLD show that the gross revenue from the sale of energy in the first six months of the year totaled $688,890,000, an increase of 9.6 per cent over the same period in 1923. The revenue in June was 6.3 per cent above June of last year. The operating expenses for the six-month period totaled $311,225,000, an increase of 11.2 per cent over last year.

The central-station companies of the South Central States reported the largest percentage gain in revenue over last year during the six months, with the Mountain and Pacific States second. The New England States, while suffering serious curtailments of energy consumption due to industrial



JUNE REVENUE 6.3 PER CENT ABOVE LAST YEAR

inactivity, yet managed to report a gross revenue 3.3 per cent above that of last year. For detail figures of central-station operations see page 458 of this issue.

Financing Interstate Merger

The eight utilities—the Southern Minnesota Gas & Electric Company of Albert Lea, Minn.; Austin (Minn.) Gas Company, Prairie City Electric Company of Prairie du Chien, Wis.; Madelia (Minn.) Electric Company, Bloomington (Wis.); Electric Light & Power Company, Gays Mills (Wis.) Electric Company, North Central Electric Company and the Soldiers' Grove (Wis.) Electric Company—which have been merged into the Interstate Power Company, a Wisconsin corporation and a subsidiary of the Utilities Power & Light Corporation, serve ninety-five cities and communities in Wisconsin, Iowa and Minnesota, with a combined population of more than 200,000. The properties are now

SYSTEM OF INTERSTATE POWER COMPANY POSSIBLE OF CLOSE INTERCONNECTION

in four distinct groups and will be connected by a 66,000-volt transmission line. Ninety per cent of the gross income of $1,869,743 for the year ended June 30 is derived from the sale of electricity for light and power.

The Wisconsin Railroad Commission has authorized securities to the amount of $12,450,000 on the combined properties, the value of which Day & Zimmermann has estimated to be in excess of $11,500,000. The company will immediately expend about $600,000 in tying together by high-tension transmission lines the Wisconsin, Iowa and Minnesota properties. With the additional property, the value back of the first mortgage bonds will be in excess of $1,840 for each thousand-dollar bond.

August Financing Heavy

During the Past Month New Light and Power Securities Reached a Total of $84,052,000

PUBLIC sale of electric light and power securities by investment houses during the month of August, exclusive of the three-million-dollar issue of the Lower-Austrian Hydro-Electric Power Company, amounted to $84,052,000, an unusually high total for that month, when financial activities as a rule reflect the general seasonal slump.

This figure, though it was indicative of a decrease of $9,701,500 under the total reached in the month of July, compares favorably with August, 1923, when securities of this type amounting to $48,507,800 were disposed of. The money raised last month was essentially new capital to provide funds for additions and betterments, refunding being almost a negligible factor. Several sizable offerings appeared, the largest individual issue being floated by the Commonwealth Edison Company, consisting of 5 per cent first mortgage gold bonds totaling $15,000,000 and offered at 98¾ to yield 5.10 per cent. Long-term financing predominated and the average yield dropped to 6.01 per cent, the lowest point of the year.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the seven-day period ended September 2:

Name of Company	Per Cent	When Payable
Central Illinois Public Service, pf.	$1.50	Oct. 15
Consolidated Gas, Electric Light & Power, pf., series A	$2.00	Oct. 1
Consolidated Gas, Electric Light & Power, pf., series B	$1.75	Oct. 1
Consolidated Gas, Electric Light & Power, pf., series C	$1.62½	Oct. 1
Consolidated Gas, Electric Light & Power, com.	$2.00	Oct. 1
El Paso Electric	$1.25	Sept. 15
General Gas & Electric, pf., class B	$1.75	Oct. 1
General Gas & Electric, pf., class A	$2.00	Oct. 1
Kansas City Power & Light, pf., series A	1¾	Oct. 1
Middle West Utilities, pf.	1¾	Oct. 15
Montana Power, com.	1	Oct. 1
Montana Power, pf.	1¾	Oct. 1
North American, com.	2½	Oct. 1
North American, pf.	1¾	Oct. 1
Pennsylvania Power & Light, pf.	$1.75	Oct. 1
Pennsylvania Water & Power	2	Oct. 1
United Utilities (semi-annual), pf.	$3.50	Sept. 1
Winnipeg Electric, pf.	1¾	Oct. 1
Wisconsin Power & Light, pf.	$1.75	Sept. 15
Boston Woven Hose & Rubber	$1.50	Sept. 15
Century Electric, com.	1½	Sept. 22
Century Electric, pf.	1¾	Oct. 1
Cramps (Wm.) & Sons Ship and Engine Building	$1	Sept. 30
Youngstown Sheet & Tube, com.	$1	Sept.
Youngstown Sheet & Tube, pf.	1¾	Sept. 30

Company Reports

Among the company reports issued during the past week for the month of July are the following:

Name of Company	Gross Revenues for July, 1924	July, 1923
Appalachian Power	$291,528	$275,711
Bangor Railway & Electric	117,411	119,503
Blackstone Valley Gas & Electric	337,210	189,622
Carolina Power & Light	183,078	160,022
Columbus Electric & Power	169,017	174,325
Commonwealth Power	2,245,868	2,232,837
Consumers Power	1,334,690	1,259,333
Cumberland County Power & Light	292,828	309,319
Edison Electric Illuminating Co. of Brockton	107,124	108,413
El Paso Electric and subsidiaries	193,574	189,622
Fort Worth Power & Light	232,472	228,994
Galveston-Houston Electric	336,971	278,646
General Gas & Electric	1,474,351	1,274,337
Great Western Power	615,108	572,417
Kansas Gas & Electric	383,960	368,501
Lowell Electric Light	104,572	114,927
Mississippi River Power	267,174	254,703
Nebraska Power	286,289	289,770
Nevada-California Electric and subsidiaries	436,821	404,890
Niagara, Lockport & Ontario Power	444,454	440,018
Northern Ohio Electric	786,409	802,328
Northern Texas Electric	201,981	226,515
Pacific Power & Light	256,299	260,357
Portland Electric Power	860,350	890,783
Philadelphia company and affiliated companies *	2,409,786	2,780,583
Puget Sound Power & Light	964,714	979,555
Savannah Electric & Power	153,813	154,669
Tampa Electric and subsidiaries	175,405	164,481
Tennessee Electric Power	733,458	714,740
Texas Power & Light	458,815	336,078
United Gas & Electric	1,064,174	1,040,213
Yadkin River Power	126,430	152,545

* Exclusive of Pittsburgh Railways

Stockholders to Vote on Interest Rate Increase.—The directors of the Winnipeg Electric Company are seeking the approval of the shareholders of the company for increasing the interest rate on the perpetual consolidated debenture stock. A special general meeting has been called for September 22 to be held in Winnipeg.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN AUGUST

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Duke-Price Power Co., Ltd. (Que.)	$12,000,000	25	First mortgage gold bonds	Construction	6	99	6.08
Commonwealth Edison Co.	15,000,000	30	First mortgage collateral gold bonds, series B	Partially reimburse for capital expenditures	5	98¾	5.10
West Penn. Power Co.	2,063,000	..	Cumulative preferred stock	Construction	7	103	6.80
Central Maine Power Co.	1,550,000	25	First and general mortgage gold bonds, series C	To provide partially for cost of plant recently acquired	5½	99	5.57
East Kootenay Power Co., Ltd. (B.C.)	750,000	..	Cumulative preferred stock	Refunding and extensions	7	97½	7.17
American Power & Light Co.	5,000,000	92	Gold debenture bonds, American series	Working capital and other corporate purposes	6	94¼	6.35
Lake Charles & Electric Co., Inc. (La.)	750,000	25	First mortgage gold bonds, series A	To provide funds for purchase of properties	5½	95	5.87
Middle West Utilities Co.	970,000	..	Prior lien stock (participating)	Acquisition of new properties and for other general corporate purposes	7	97	7.22
Consolidated Power & Light Co. of South Dakota	350,000	1	Mortgage lien gold notes		6	99	7.05
Keyser Light & Power Co. (W. Va.)	125,000	20	First mortgage gold bonds	Construction	6½	100	6.50
Rockford Electric Co. (Ill.)	924,000	15	First and refunding mortgage gold bonds	To reimburse for construction expenditures and for other corporate purposes	5	98	5.20
Indiana Hydro-Electric Power Co.	1,500,000	27	First mortgage sinking-fund gold bonds, series B	Construction	6	95½	6.35
Standard Gas & Electric Corp.	3,500,000	..	Cumulative prior preference stock	To purchase controlling interest in Northern States Power Company	7	95½	7.33
New York Central Electric Corp.	2,100,000	26	First mortgage gold bonds	Acquisition of new properties	5½	97	5.70
Cumberland County Power & Light Co. (Me.)	1,000,000	..	Cumulative preferred stock	To partially reimburse company for cost of new additions	6	86	7
Chester County Light & Power Co. of Pa.	200,000	30	First mortgage bonds		6	99	6.07
Consumers' Power Co. (Del.)	450,000	23	First lien sinking-fund gold bonds, series A		6½	98½	6.65
North American Co.	10,000,000	..	Cumulative preferred stock	Acquisition of income-producing investments and for retirement of interest-bearing indebtedness	6	48	6.25
Missouri Power & Light	1,200,000	19	First mortgage and refunding general lien sinking-fund gold bonds, series B	Acquisition of properties and securities, additions and refunding	6½	98½	6.60
New Orleans Public Service, Inc.	1,650,000	11	General lien gold bonds	Construction	4½	86½	6.25
Pacific Gas & Electric Co.	12,500,000	28	First and refunding mortgage gold bonds, series C	Improvements and extensions	5½	98	5.65
American Gas & Electric Co.	9,000,000	90	Gold debenture bonds (American Series)	To reimburse company for acquisition of common stock of another company and other corporate purposes	6	95½	6.30
Toledo Edison Co.	1,470,000	..	Cumulative preferred stock, series A	To reimburse for capital expenditures, for working capital and other corporate purposes	7	98	7.14
Total	$84,052,000						

Recent Court Decisions

Heirs of Electric Crane Operator Who Was Killed by Grasping Live Fallen Wire Did Not Forfeit Compensation.—The Appellate Court of Indiana has held, in Marion Malleable Iron Works vs. Ford, that the death of an electric crane operator by electrocution, after grasping a defectively insulated electric feed wire to remove it from railway tracks in the street, to which it fell when severed by his crane boom, was compensable as "arising out of and in course of employment," even though he may have been negligent. The Industrial Board of the state had so decided, and the court refused to disturb this decision, against which the employer appealed. (144 N. E. 552.)*

Company Permitted to Sell at Less than Maximum Rates in Competition with Municipal Plant.—In City of Watertown vs. Eastern Dakota Electric Company the city obtained a temporary restraining order from the District Court on the allegations that the company had reduced its rates below those prescribed in the ordinance governing them and was selling its product at less than cost of production in order to prevent the municipal plant from doing business except at a loss. The company relied on a judgment rendered in a former action instituted by the city against the company to enjoin the company from putting into effect a proposed schedule of rates which was an increase over then existing rates but would be less than permitted by ordinance. In this case the Supreme Court of South Dakota had held that the ordinance was a contract not subject to impairment, and that under it the company had the absolute contractual right to charge such rates as to it might seem best, so long as it kept within its contract by not charging in excess of the maximum price fixed thereby. This contention of the company was upheld in the United States District Court and has been affirmed by the Court of Appeals, the restraining order obtained by the city being vacated. (296 Fed. 832.)

Upper Riparian Owner Must Not Discharge Water in Such Great Volume as to Cause Waste to Lower Owner.—The Court of Appeals of New York State has affirmed judgment for the Fulton County Gas & Electric Company against the Rockwood Manufacturing Company in a suit involving their respective rights to the waters of Caroga Creek, on which the manufacturing company is the upper and the power company the lower riparian owner. Both companies have erected dams, but the defendant has no power plant and does not use the water stored on its site. It was charged that in attempting to make certain repairs the defendant closed the gates of its dam at certain periods in 1920 and unreasonably shut off the supply of water coming down to the plaintiff's power house, thereby threatening its use and operation. Having collected the water behind its dam, it suddenly, without notice to the plaintiff, and at times when the need for water by the plaintiff was at the lowest, opened the gates of its dam, discharging about seven times the natural flow, thereby causing the plaintiff's forebay dam to be flooded and the water wasted. Such action is declared by the court to be an unreasonable and unjustifiable interference with the rights of the power company and a proper matter for injunction. (144 N. E. 359.)

Municipal Electric Lighting Plant Held Within Purview of Factory Act.—Bollinger vs. Hill City was an action to recoved damages because of the death of a man whose arm was caught in a revolving shaft while he was working in a municipal lighting plant. The Supreme Court of Kansas sustained a verdict for $10,000, holding that a municipal electric lighting plant had rightly been assumed to come within the scope of the factory act and that a person laboring there, even though not an employee of the municipality, came under the protection of this act. The victim of the accident, having been invited by the plant superintendent to take charge during the noon hour, was not a trespasser. (227 Pac. 265.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Principles Governing Cooking and Heating Rates.—In establishing a cooking and heating rate for electric service in Colby, Wis., at a figure less than the average cost of energy purchased on the basis of kilowatt-hours sold, the Wisconsin Railroad Commission said: "Cooking and heating rates, as well as power rates, are not based on the average cost. The high average cost is due primarily to the fact that the greater portion of the energy used at Colby is for lighting purposes and the high demand is the lighting demand. Experience in other communities indicates that undoubtedly a large motor and heating load could be added in Colby without materially affecting the demand component of the bill for service. Further, the excess energy purchased over and above what is now being purchased will cost the utility 2½ cents per kilowatt-hour. Any heating, cooking or power business added, therefore, which does not affect the peak demand would be entitled to a rate based on the cost of serving that class of business, and such a rate might very well be less than the average cost."

City Service Outside Corporate Limits.—An increase of 25 per cent to customers of a municipal water plant outside the city limits was authorized by the Wisconsin Railroad Commission in a case affecting the city of Stoughton. The commission pointed out that the city had lent its credit to the utility, thus enabling the financing of the water project upon more favorable terms than would have been obtained if the plant and its business alone stood security therefor, that the city had foregone profits, and that the city had no power to enforce collections by adding delinquent bills to the tax roll of property served outside its corporate limits. The commission continued: "The commission has pointed out in previous decisions that if the city and its taxpayers have foregone anything which they were not obliged to or which they would not have foregone if the water service had been supplied by a privately owned utility, then it would seem just and reasonable that the city and its taxpayers might require that such benefits should accrue only to consumers residing within the city limits. On the other hand, consumers located outside, who have foregone nothing as taxpayers, shared no risk in building up the plant, and whose property stands security for the payment neither of bonds nor delinquent debts, cannot expect to share in the benefits accruing from these advantages. From the analysis of the position of the outside consumers noted above and as discussed in previous decisions, the justice to both the city and non-residents of a differential in the rates charged in certain cases appears clear."

Various Retrogressive Claims of Value Disallowed.—Refusing to increase its valuation of the property of the Kootenai Power Company as arrived at last year, the Idaho Public Utilities Commission disapproved of a claim that $18,816 should be added to cover services alleged to have been rendered in former years by various individuals for which no charges were made on the books and no money paid, holding that if such an obligation had been incurred, it had already been discharged by the public, "even though the officers did not see fit to properly distribute same to those to whom it is alleged to be due." Concerning other claims of the company the commission said: "Certain value is claimed on account of preferential rates or conditions given to customers, said to have been necessary to retain business and prevent the installation of a private plant. The commission does not sanction the practice of giving preferential rates to retain business or otherwise. Such practices are against the spirit if not the letter of the utility law of this state. To capitalize this loss (called by the company a 'saving') would be absurd. If such action as that could be taken by the company, it is rather an indication that the rates were too high than that the value of the plant is too low. The company claims certain value for electricity bought in excess of amount used. We do not understand fully the theory that when a company pays for more than it gets in electric service the excess over and above the amount used should be capitalized to the detriment of future users. If more was paid for than was used, it should not now be capitalized fifteen or more years afterward."

Manufacturing and Markets

Steps in Aid of the Electric Vehicle

A Suggestion that Gasoline Car Garages Should Be Utilized as Charging Stations with Co-operative Support from Manufacturers and Central Stations

BY A VEHICLE MANUFACTURER

CONSIDERING the advantages of electric trucks and delivery wagons, it is surprising to many persons in the electric vehicle business that more are not used. Unquestionably they will be used more extensively when the first cost can be reduced by greater demand and consequently greater production and when some radical development is made in batteries which will permit storing larger quantities of power per unit of volume and weight. But it is very much to the interest of the electrical industry broadly that the electric truck market be developed rapidly because of the great volume of collateral business that will come with it in the sale of control and battery equipment, the consumption of energy and the provision of charging facilities.

As a matter of fact, even in the present state of development and production, however, experience has shown that a decided financial economy can be made in most circumstances by using electric vehicles. This is admirably brought out by facts and figures in the book by Edward E. LaSchum, superintendent of motor vehicles American Railway Express Company. Coming from a man who has "no axe to grind," these figures should have great weight with skeptics. Those who disbelieve—the users of horse and gasoline vehicles—must be converted to the value to themselves of accurately accounting for their transportation expenses in order that comparisons may be made.

TIE IN GASOLINE GARAGES

One thing certainly can be done now, however, to minimize the objections to the use of electric vehicles, and that is to make battery-charging and service facilities relatively just as available as gasoline-car service. Special garages do not have to be financed, built and operated, although any one who has the courage and foresight to do so should be commended. Countless gasoline car garages would be glad to give electric vehicle service if it did not involve too great an expense. Therefore, to get things started, groups which will benefit by electric vehicle operation—vehicle manufacturers, battery manufacturers or central stations—singly or jointly, could well afford to install charging equipment in carefully selected garages in different sections of each community and rent them to the garage operator on a flat-rate basis, or on the basis of the amount of charging done, or a combination of both.

The location of such facilities should be advertised to every existing and prospective user of electric vehicles to let it be known that they will be in no danger of getting stalled at some remote point and having to be towed in. Such information could be provided in booklets of service stations given to each car user, in the individual or joint advertising of vehicle and battery manufacturers and central stations, on conspicuous signs in front of garages or on road signs. Garages could be shown the business they can attract if they give publicity to their service. In conjunction with this battery manufacturers might give instructions to garage men in the use and care of batteries.

CO-OPERATIVE SUPPORT

With service facilities more generally available, manufacturers of electric vehicles and batteries and central-station companies should unite their efforts in creating a demand for electric vehicles. If they cannot see the justification for doing such promotional work unaided, steps might be taken for co-operative effort in proportion to the benefit which each receives in the long run. Vehicle and battery manufacturers could calculate what profit they could receive from original sales, repeat orders, repair parts, and the advertising gained by putting more vehicles on the streets. Central-station companies could figure their profit in sale of energy, the benefit of the off-peak charging or diversity of load and the value of creating a public consciousness that nearly everything is possible with electricity. These benefits should be calculated by each group for a period of ten to twenty years, and each should then agree to contribute, in proportion to the benefits received, time, effort or money to create a demand for electric vehicles.

One aggressive group can accomplish wonders, but co-ordinated joint effort will be even more successful. To bring about the latter requires a recognition of mutual benefit, a submersion of selfish interests, a desire to co-operate, the establishment of a working body with representation of the groups interested, a program of procedure, allocation of responsibilities and aggressive enthusiasm.

Why wait until a Ford comes along in the industry to put across the idea unaided? Think of the benefits to be realized in the meantime. The first step which can be accomplished without further delay is to set up more gasoline-car garages serving as electric-vehicle charging stations.

Advertising for Export Trade

WELL-PREPARED advertising matter and attractive samples and advertising novelties offer one of the most effective means of stimulating trade in foreign countries, but unless shipments of such articles are properly handled they retard rather than promote trade, according to a recent trade bulletin of the Department of Commerce, outlining in detail the various methods available and the costs of shipping samples and advertising matter to Latin America and the West Indies. Owing to the lack of information on the subject, American firms have had many unpleasant experiences through failure to take some factor into account and necessitating the payment of excess charges by the prospective customer. Invariably such occurrences incur the ill will of the addressee, who frequently abandons the package rather than suffer the expense and delay attendant upon clearance through the custom house.

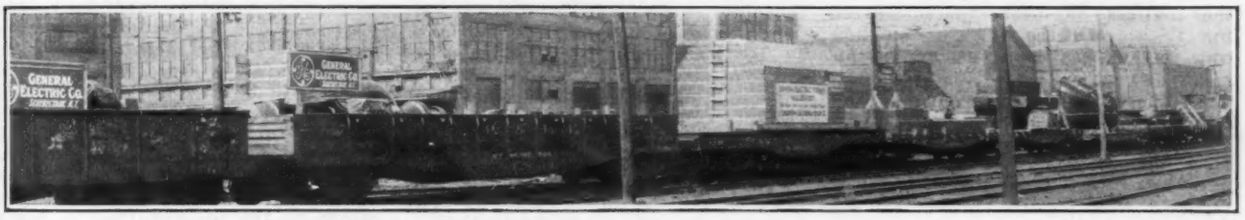
A study of this phase of export

trade has been undertaken by the Bureau of Foreign and Domestic Commerce. Definitions of samples and advertising matter, methods of shipment, handicaps of parcel post, duties, prepayment of duties, marking and documentation applicable to all countries are fully discussed in reports which may be had without charge for all countries (excepting the Near and Far East, reports for which are not yet completed) upon application to the division of foreign tariffs, Department of Commerce, Washington, D. C., or from any district or co-operative office of the Bureau of Foreign and Domestic Commerce.

The Rush Shipment to California

How Twenty-two Carloads of Electrical Equipment Were Dispatched in Record Time—Result of Close Co-operation Among Manufacturing Departments

A SPECIAL train of twenty-two carloads of electrical equipment, valued at approximately $1,000,000, left the Schenectady works of the General Electric Company Saturday night, August 23, nine weeks ahead of schedule. This train-load was a contribution toward combating the water-power shortage in California and was consigned to the Southern California Edison Company. When it is realized that the shipment included a large turbo-generator and that orders for the electrical equipment were placed with the General Electric only in January, the magnitude of the achievement becomes more fully apparent. Details of the material included in the shipment appeared in the news columns of the ELECTRICAL WORLD last week.



PART OF TWENTY-TWO-CAR SHIPMENT BEING ASSEMBLED

CLOSE CO-ORDINATION THE KEYNOTE

Close co-ordination throughout the plants of the General Electric Company made possible the shipment of this equipment in record time. When the contract for the equipment was given to the company in January promise of shipment was made for October. As the work progressed the shipment date was advanced, with the result that August 23 saw the work completed on all of the individual units. The Pittsfield works sent a rush shipment of six carloads of transformers to Schenectady on Friday night, August 22, and Bloomfield dispatched the control apparatus to Schenectady by motor truck, the shipment arriving Saturday. On Saturday the facilities of the General Electric traffic department were put at the disposal of those in charge of the shipment, and the train made up and dispatched for California at 6:29 p.m. A personal tracer from the General Electric accompanied the shipment across the continent and watched closely to prevent delays because of damaged rolling stock. Careful inspections were made at every stopping point.

The acute power situation which made this shipment so urgent is caused by one of the greatest water shortages in the history of California. The unprecedented drought has resulted not only in a shortage of power but also in an increased power demand by farmers for irrigation pumping. The industry, however, has responded to the demand and is rapidly taking steps, as evidenced by this shipment, to relieve the situation.

French Electrical Manufacturing Industry

DEALING with the progress made in recent years by the French electrical manufacturing industry, a correspondent of the Paris *Information*, as quoted by the *Electrical Review* of London, recalls the fact that although a remarkable development began in 1900, the country still had to import, particularly from Germany, dynamos, electrical apparatus, lamps, cables and wire and accumulators and batteries of the total value of 34,000,000 francs in 1913. The manufacturing industry in 1913 had available a capital of slightly more than 300,000,000 francs, but in 1923 the capital resources had grown to over 1,500,000,000 francs and the productive capacity of the works had risen by from 300 to 500 per cent. Under these circumstances it is now possible for the dynamo makers to place on the market machines of the value of 300,000,000 francs per annum as against 70,000,000 francs ten years ago; the cable and wire industry, products of the value of 100,000,000 francs as compared with 40,000,000 francs, and accumulators and primary batteries have made similar progress. In the case of electrical apparatus, of which makers were only able to supply a quantity representing 45,000,000 francs in 1913, the exports in some years since the armistice have amounted to 100,000,000 francs per annum.

Taken as a whole, the manufacturing industry now has a capacity for supplying products worth 1,200,000,000 francs per annum as contrasted with only 200,000,000 francs ten years ago, and it is noted that not only has the production been increased, but also that new manufactures which were formerly not turned out are now being made by French works. Thus, for instance, when the Compagnie du Midi undertook the initial electrification of its lines in the Pyrenees, it was compelled to have recourse to foreign insulators. At present, however, there are works which are sufficiently well equipped to supply the whole of the national requirements in electrical porcelain and to engage in export trade as well. Simultaneously the wireless telegraphy and telephony branch has received an exceptional impetus.

Before the war Germany had succeeded in inundating France with metallic-filament lamps, but the efforts made from the same source to regain the French market since

the end of hostilities have failed. It is considered that the development which has taken place in recent years permits France to proceed with the electrification of the railways and of the country districts without having to obtain a large portion of the necessary equipment from other countries. The remarkable results obtained have been due to a concentration of efforts and of plant and have necessitated large appeals to the investing public. The writer of the *Information* article states that the country is now not only able to dispense with making purchases from abroad, but it is also equipped for supplying many markets which were until recently monopolized by the Germans. The only fear appears to be of American competition, although the dollar quotation will protect the French works against this eventuality for a time.

Business Conditions

SALES during August have been reported as being better than in July, and renewed activity has been prominent in the market. Although no equipment has been purchased for stock by jobbers and dealers for about a year, many active inquiries have been received by manufacturers within the past two weeks for apparatus to be stocked. These are the first indications that material has been even considered for these purposes. While building construction has been declining, this has not yet affected the electrical market, and sales of schedule material have been large.

It is encouraging to note that some steel plants which had been closed have reopened. Along with this it is reported that pig-iron production for August, after having suffered a heavy reduction during the past four months, has shown a gain of about 6 per cent. In the case of steel production, figures on which are not yet available for August, the increase is expected to be even greater.

In the New England district sales of specialized apparatus has been very good and a more active market is noticeable. Sales have been good but demand spotty in the New York district, and central stations have been active in soliciting quotations for apparatus. In the Southeast activity has been renewed with the approach of harvest time, further assisted by the prospects of a good cotton crop. Satisfactory orders for line materials and poles have been placed in this district by central stations and municipalities. Trade has been steady in the Middle West and in good volume. Sales of pole-line hardware in this territory have been good and radio business is on the increase. On the Pacific Coast utilities are purchasing actively, and prospects in the lumber industry are fully as good as a year ago.

Use of Feeder Reactors on Increase—Demand Spotty

THE current-limiting reactor is becoming more generally installed in the large metropolitan areas, where perhaps its best application is found, on feeder circuits primarily, but also between bus sections. With continuity of service becoming more and more important, the use of feeder reactors is on the increase, but because of the engineering reasons back of their use the demand will probably be spotty. It is believed by one manufacturer that within a short time no large generating station or substation feeding a large mixed power and lighting load will be built without reactors in the feeder circuit.

Deliveries are fair and shipping schedules have been continually reduced with the slowing up of business, so that shipments on an order of medium size can be made in about three and one-half months. In general, reactors can be furnished to meet installation requirements. As a reactor is made largely of copper, perhaps 50 per cent of the manufacturing cost being that of the copper cable, the price is materially affected by fluctuations in the copper market.

Induction Feeder Regulator Demand Good

THE demand for induction feeder regulators has been very good and has virtually tripled during the last three years. This is in line with the growing tendency on the part of public utilities to improve service to customers, especially when it is considered that with improved service due to better regulation increased revenue results. It is believed that an increasing number of regulators will be used and that business on these lines will continue at a fair rate throughout the remainder of the year. Along with the increasing demand for feeder regulators the conditions to be met relative to service have also materially stiffened. This means that considerable development work is carried on at all times to produce a product which will give lasting service under the more severe conditions imposed. For this reason regulator design has changed radically, although the operating principles remain the same.

The future demand for induction feeder regulators appear to be quite promising, because of the large expansion program of the public utilities and also because of the idea of increased service to customers. The future trend appears to be toward larger units more ruggedly constructed. The growth of generator voltage regulators should be in line with the increase in the generator capacity. Deliveries are good and are within the requirements of the trade on standard lines, while they are considered reasonable on special regulators. No revisions in price are contemplated, the price trend being stationary.

Upward Trend Seen in Demand for Farm-Lighting Plants

A NATURAL improvement in business is being noted by the manufacturers of farm-lighting plants, and the general output for them is very encouraging. Farm-lighting plant business has passed through a long period of serious discouragement on account of the depressed financial condition of the farmer. However, there has been a splendid increase in crops and crop values with a corresponding reflection on this market. It is estimated that about twenty thousand plants a year are being sold, and this figure is now slowly but steadily increasing. Manufacturers agree that the future should be especially good as by far the majority of the farmers desire to have electricity and will do so just as soon as their money conditions improve. In addition, it is felt that a market will be open for larger sets to replace smaller ones where the farmer has been educated in the art of applying electricity to the many things it can do, and therefore more available power will be needed. At present the average set sold is rated at about 1,000 watts. The various uses to which small light and power plants are put other than on farms make up about 20 per cent of the total volume of business, which at the present time is said to be fair.

Deliveries are good because manufacturing facilities are larger than are required by the present demand. Prices will probably remain stationary for some little time, the last price revision having been upward and approximately 5 per cent. This upward revision was on account of the increased cost of selling the product—not that it required any considerable argument to sell a plant; the farmer was quite ready to buy but was simply financially unable to do so. No price revisions are now in progress, but other conditions remaining the same, the price trend will be downward as the volume increases.

Non-Ferrous Metal Market Stronger—Tin Demand Good

THE market is now somewhat stronger than a week ago and sales have been good but reduced on account of the holidays. There seems to be no disposition on the part of sellers to force sales by reducing prices. The London market is either steady or has advanced in price. Since last Friday, when nearly 2,000,000 lb. of copper was sold at 13⅜ cents, there do not appear to have been any speculative lots in the market, and producers are not selling below 13¼ cents, while some are asking 13⅜ cents. Brass and wire manufacturers have been principal buyers during the week. Many purchasers have been asking for October-November shipment, and prices have

been quoted the same for the balance of the year. Foreign demand has been good.

Lead has remained at the same price; sales have been moderate with most of the business transacted on the St. Louis market. Inquiries are for early shipment, indicating that consumers have only small supplies of lead in stock.

Zinc prices have advanced slightly,

NEW YORK METAL MARKET PRICES

	Aug. 27, 1924 Cents per Pound	Sept. 3, 1924 Cents per Pound
Copper, electrolytic	13½–13¾	13⅝–13¾
Lead, Am. S. & R. price	8	8
Antimony	10¼	10¼
Nickel, ingot	27	28
Zinc, spot	6¾	6¾
Tin, Straits	51¼	52¼
Aluminum, 98 to 99 per cent	28	28

due to the advance in ore prices. The market has not been very active, though one interest has taken very large tonnages in the last two weeks. The demand for tin for immediate shipment has been good, and prices have again increased slightly.

Apparatus Sales Encouraging in New England Territory

RENEWED activity in the electrical market made its appearance after the holiday, and representative jobbers expect a good month's trade. The sale of specialized apparatus, and particularly of electrical devices associated with testing, is running well ahead of a year ago. Safety switches, electric signaling equipment, public address radio systems and fixtures are making good records, and one jobber reports the best fixture trade in six years. Motor sales are running about 25 per cent under last year's figures, allowing for the price reductions made early in the year. Electric ranges are moving fairly well and the market around Boston has never quite lost the impetus of last winter's cooking school under co-operative auspices.

Oil-switch batteries are active, and the demand for radio batteries is expected to increase rapidly from now on. Battery distributors report more sales for industrial truck service than a year ago, diversified manufacturing establishments being the buyers. In response to hard work appliance sales are "looking up" somewhat, and in ten central stations these gained from $7,972 to $8,140 in the last reported two weeks' period. An order for 50,000 ft. of loom has been received from Maine by a Boston jobber after a long dull period with little buying from this section. Prices are steady, general business and manufacturing conditions being somewhat better.

Renewed Activity Evident in the Southeastern District

BUSINESS is showing renewed activity in the Southeast with the approach of harvest time, especially in the small centers, and this activity is, of course, assisted by the better prospects for a good cotton crop. This has further served to put the textile industry in a more optimistic position, and as a result electrical material sold to this class of purchaser is increasing in demand. One jobber reports figuring on several large power and light jobs, with very good prospects for closing them within the next few days.

Central-station companies as well as small municipalities are placing satisfactory orders for line materials and also for poles, the latter moving in an especially brisk way. Small distribution transformers of from 1½ kw. to 10 kw. are very active and meter sales are steady. There is a slight slackening up noted in the demand for residential wiring materials in some sections, but heavy materials continue their active trend. Switchboards are in fair demand and panelboards are very active. Radio sales have obtained a good start with fall business, the cabinet-type model becoming more and more popular. The general tendency is toward the purchase of the better class of radio equipment, and deliveries on this type are lagging behind the demand.

Demand Spotty but Sales Good in New York District

SALES during the month of August in the New York district are said to have been better than in July, although the demand has been spotty. Central stations have been active in soliciting quotations on apparatus, orders for which are expected to be placed this month. Material for a Pennsylvania water-power development which will total nearly $1,000,000 is expected to be purchased within the next two weeks. Sales of meters, transformers and similar material are very good. Motor business is still off as compared with last year, but within the last two weeks, for the first time in nearly a year, jobbers and dealers are making inquiries for apparatus for stock.

Jobbers are confident that the present upward trend will continue as a stronger feeling of confidence is being expressed by dealers. Much building construction material has been sold; in fact, one jobber reports that the last sixty days have witnessed the largest movement in this class of material for some time, but at prices that are exceedingly low and on a very close margin. Washing machines, vacuum cleaners and other appliances which have been aggressively pushed during the last month have sold very well. The partial-payment plan for selling radio apparatus, which has been now widely introduced so that all dealers can take advantage of it, is expected to boost the volume of business considerably. Collections are said to be off, but this is usual at this period.

Trade in Middle West Steady but Uneventful

THE volume of business in most lines throughout the Middle Western territory remains about the same as in the previous week. There have been no price changes of any consequence, but advances are looked for in most lines during September provided the fall brings with it a larger volume of trade. Sales of pole-line hardware are slightly above last year's at this time. Low prices on poles still exist, with some producers making large reductions to get business. There is the feeling, though, that pole prices will not remain long where they are, although just what will occur is rather indefinite.

Practically all manufacturers of code wire have fallen in line with the increase during August. No further advance is looked for soon. Complete stocks are being warehoused in anticipation of increased sales. Radio business is still on the increase, with jobbers predicting a much larger business than last year. The unreliable and "fly-by-night" radio manufacturers, who have been present in such large numbers, are being eliminated to a great extent this year. Most dealers have learned their lesson and are confining their purchases to reputable lines. Prices as a whole on radio seem to have decreased. The building industry is not so active as at this time last year or last month. Feeling exists in some parts that perhaps for the time being the city housing needs have been taken care of. Facts from farm bureaus would indicate that building is moving countryward since small-town dwellings are being erected in as large a number as a year ago.

Utilities Purchasing Actively on Pacific Coast

AMONG recent large orders placed on the Pacific Coast are nine carloads of fiber conduit from a northern California power company, $10,000 worth of porcelain insulators from a southern California power company and a $148,000 contract for electrical work on a new telephone building being erected in San Francisco. Inquiries from central stations in the Northwest for heavy equipment are expected to materialize into orders within a few weeks. In southern California the water shortage has worked a great hardship. The recent twenty-two car shipment of electrical equipment for a steam plant, which was rushed through from the East in eight days, reflects the effort that is being made to reduce the ill effects of the water shortage. Prospects in the Northwest lumber industry are fully as good as they were a year ago—production and sales during the month of August comparing very favorably with those of that time.

Building construction in the interior cities of the Coast is very good. Eastern manufacturers of schedule material who maintain Coast stocks report better movement, although their stocks are still high. Retail trade is of itself rather dull in some sections, but has been improved by the stimulation of special sales. Light crops and high prices are the rule, and as this crop money will soon be in circulation retail business will show an appreciable improvement. Several inquiries are being received from agricultural sections for farm-lighting plants. Rubber-covered wire has increased about 5 per cent in price, and although considerably decreased prices on poles are reported, prices on local shipments are little affected, presumably because of depleted stocks.

Activities of the Trade

Link-Belt Holds School for Distributors' Salesmen

The Link-Belt Company, Chicago, has adopted a new plan of bringing its distributors' key men to its factory, where they may see the products in process of manufacture, listen to prearranged lectures and become more fully acquainted with general manufacturing procedure, policy and personnel. The company allows each distributor to select the salesmen for attendance at this "school on manufacture," paying all expenses incident to the three-day visit except the value of the salesmen's time.

Beginning August 25, the company held a three-day school at its Ewart works in Indianapolis under the direct supervision of George Torrence, sales manager. Those in attendance represented fourteen distributors, scattered from Maine to Texas.

Quality Appliances Company Produces Porcelain Iron

The Quality Appliances Company, 277 Gage Road, Riverside, Ill., has recently been incorporated and is now producing an electric iron with a porcelain top and handle rated at 450 watts, 110-120 volts. Present tool equipment and manufacturing space are available to turn out 2,400 irons a month, and the organization has provisions for doubling this capacity within sixty days. A distinctive feature of this iron is that the porcelain top holds the heat down in the iron. The company is seeking a wider distribution and is also contemplating the manufacture of other porcelain appliances. The officers are Nelson S. Moore, president; Walter de L. Carr, treasurer, and George Clark, secretary.

Electric Furnace Construction Forms Merger

The Electric Furnace Construction Company, Philadelphia, and the American Industrial Furnace Corporation, Boston, have merged to form the General Furnace Company, with head offices at 1015 Chestnut Street, Philadelphia. Considerable new capital has been introduced into the new company, which will handle the specialties of both the old concerns, consisting of the electric elevated type of furnace, the electric rotary hearth furnace, special types of electric furnaces, the Soderberg continuous self-baking electrode, etc.

The new company announces that the services of the engineers and personnel of the old companies are retained as well as those of L. C. Loshbough of Chicago, formerly designer of the Industrial Furnace Company of Chicago. Branch offices will be maintained at 160 La Salle Street, Chicago, in charge of L. C. Loshbough, and at 185 Devonshire Street, Boston, in charge of G. C. Garland. The officers of the new company are T. E. Brown, president; Frank Hodson and H. O. Breaker, vice-presidents, and M. G. Hopkins, secretary and treasurer.

Arrow Electric Buys Porcelain Factory in New Jersey

The Arrow Electric Company, Hartford, Conn., manufacturer of wiring devices, announces the purchase of the Washington Porcelain Company, Washington, N. J., and will operate the plant under the same name, producing solely for itself. The Arrow company was the New Jersey company's biggest patron. Harold H. Humphrey will continue as general manager of the New Jersey plant. Control of the company was obtained by stock purchase.

Judge Arthur L. Shipman of the law firm of Shipman & Goodwin and Daniel J. Glazier, treasurer of the Hartford Fire Insurance Company, have been added to the Arrow directorate.

P. A. Geier Moving Into New Factory

The new factory units of the P. A. Geier Company, Cleveland, which have been under construction since last winter, are practically completed, and machinery is being rapidly installed. The additions include a four-story reinforced concrete building, 66 ft. x 240 ft., with a 66-ft. x 56-ft. wing and a two-story addition to part of the old building.

Manufacturing operations in the new space began last month, and the complete plant is expected to be in full operation early this month. With these additions the Geier plant will have approximately three times the floor space previously occupied, with proportionate increases in the production capacity of Royal electric cleaners, vibrators and hair driers.

Nashville Bridge Receives Transmission Tower Order

The Alabama Power Company has recently closed a contract involving approximately $100,000 with the Nashville Bridge Company's Birmingham plant to fabricate approximately 800 tons of material for 110,00-volt steel transmission-line towers. The towers will be 40 ft. to 60 ft. high and of the type now in general use throughout the Alabama Power Company's system. The order will be sufficient for the construction of 30 miles of double-circuit lines to be built in the state during the early part of 1925.

The Everhot Heater Corporation, 214 Woodbridge Street, Detroit, manufacturer of electrical heating apparatus, has awarded a contract for the construction of a one-and-one-half story plant, 75 ft. by 225 ft., on Lafayette Boulevard, to cost $38,000.

The Wagner Electric Corporation, St. Louis, announces the appointment of D. K. Rivas as manager of its New York office, 50 Church Street.

The S. A. Woods Machine Company, Boston, announces the appointment of E. G. Benedict as general sales representative of the electric motor department. Mr. Benedict has been Boston district manager for the Lincoln Electric Company for the past six years.

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., and the **Champion Switch Company**, Buffalo, have opened a joint office at 2 Rector Street, New York, where a complete line of the products of both companies are on display. George C. Oxer, district sales manager, is in charge of the office.

Johns-Manville, Inc., 292 Madison Avenue, New York, announces that a new "Orangeburg fiber conduit" plant is operating at Richmond, Ind. This added capacity, together with the plants at Orangeburg, N. Y., and Fulton, N. Y., is intended to insure prompt deliveries and lower freight rates to fiber-conduit users in the Central and Southwestern States.

Brown, Boveri & Company, Baden, Switzerland, manufacturers of electrical apparatus, have just issued a well-illustrated 101-page booklet devoted chiefly to a review of the field of activity of the company and to a description of the Baden and Munchenstein works. A brief historical note concerning the company and a list of affiliated companies and sales agencies are also included.

The Fafnir Bearing Company, New Britain, Conn., announces that Stanley Cooper has been appointed advertising manager to succeed P. N. Case, who has resigned to take charge of the Blair Manufacturing Company, Springfield, Mass.

The Bakelite Corporation, 230 Grove Street, Bloomfield, N. J., manufacturer of electrical insulation products, has awarded a contract for the erection of a two-story addition to its plant to be used for laboratory and other service, estimated to cost $55,000.

The Fuerst-Friedman Company, Cleveland, dealer in used motors, generators, etc., announces that it will soon move to new quarters at the corner of Hamilton and East Fifty-third Streets.

The Gibb Instrument Company, Bay City, Mich., has appointed F. J. De Lima agent for the sale of its line of electric welding and electric heating machines in the Dominion of Canada. Mr. De Lima's headquarters are in the Keefer Building, Montreal.

The Poindexter Supply Company, for a number of years at 1440 Stout Street, Denver, has moved to the building of another jobber, the New England Electric Company, 1951 Lawrence Street. Although the two firms are not merging, it is understood that they will coordinate closely.

The G. F. Mitchell & Sons Company, Cleveland, announces the appointment of William Campbell, who will organize the sales of "Washrite" washing machines on a national scale. This company, whose experience in the manu-

facture of sheet metal and mechanical products extends back to 1874, has been manufacturing and selling washing machines in limited territory for about three years.

The Reliance Electric & Engineering Company, Cleveland, manufacturer of electric motors, has been awarded a contract by the Libby-Owens Sheet Glass Company, Toledo, Ohio, for furnishing the electric motors for operating the grinders and polishing machines in the new sheet-glass plant under construction at Toledo.

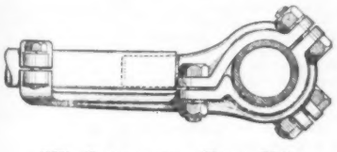
The Sangamo Electric Company, Springfield, Ill., manufacturers of Sangamo meters, has appointed L. Brandenburger as its agent at Salt Lake City, Utah. Mr. Brandenburger has long been connected with the electrical industry and represents, in addition to the Sangamo Electric Company, the Delta-Star Electric Company, the Wagner Electric Corporation, the States Company and the Roller-Smith Company.

The Baltimore Foreign Trade Service Corporation has been organized under the laws of Maryland to promote and develop the foreign sales of Baltimore manufacturers by establishing direct selling connections in all the important trade centers of the world through substantial foreign business houses competent to handle the foreign sales of specific commodities. These foreign houses will act as representatives and jobbers for the Baltimore manufacturers and will be in an advantageous position to make effective distribution through their own local markets. The president and active manager of the new company is John P. Bushnell, who was formerly with the Du Pont Export Company and recently trade commissioner of the Bureau of Foreign and Domestic Commerce.

New Equipment Available

"T" Connector

A "T" connector, known as the "Burndy," has been developed by the Burndy Engineering Company, Inc., New York, for tubing cables and solid buses, to meet the heavy demands to which outdoor substation apparatus is subjected. By providing both arms of



"T" CONNECTOR, TYPE HG

the connector with a 45-deg. overhang on opposite sides of the main conductor, as shown in the illustration, the main contact is made independent of bolts. These connectors also have a three-plane grip whereby the main conductor is gripped by the connector and the bolting force applied at three points on the circumference, insuring an efficient contact of high conductivity. A mechanical grip at the base of the connector relieves the main electrical contact of mechanical strains and is said to prevent failures due to the crystallization of the conductor at one point by distributing the forces of flexure. Various types of "T" connectors are made to meet the different requirements.

Inclosed Circuit Breakers

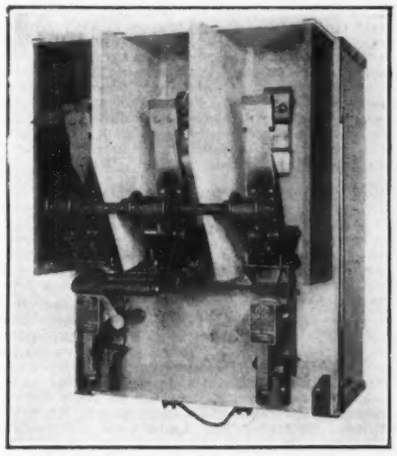
The inclosed line of circuit breakers made by the Cutter Company, Philadelphia, and sold under the trade name of "U-re-lite" has been expanded by the development of the "Auto U-re-lite W" for 220 volts or less alternating current or 250 volts three-wire direct current in capacities from 5 amp. to 400 amp. and for 440-550 volts or less alternating current, 5 amp. to 200 amp. The "U-re-lite W," for use on 250 volts or less direct current or single-phase alternating current in capacities from 5 amp. to 400 amp., and the "U-re-lite NX," for use on 250 volts or less direct current only in capacities from 100 amp. to 1,250 amp., are also new developments added to the line.

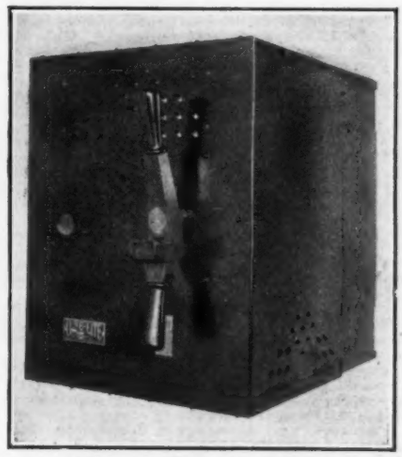
These new "U-re-lites" are larger in size and heavier in construction than the smaller types and are built with heavier parts and more liberal spacing to withstand the severe duty for which they are intended. Like the smaller types, they are so constructed as to make it impossible to close them effectively against an abnormal circuit condition, and at the same time they furnish complete protection to the operator. They are furnished with overload instantaneous trip or overload with "Dalite" (direct-acting time-limit) features. Auxiliary features as no voltage, shunt trip and bell ringer or any other special features may be included if required.

Electric Pipe Threader.—A new motor-driven, portable electric pipe threader, for use on pipe from ¼-in. to 2-in., has been placed on the market by the Oster Manufacturing Company, Cleveland. A built-in vise aided by an auxiliary chuck, both of which are self-centering and self-locking, holds the pipe securely in place while the die stock is being turned by the motor. In addition to threading the pipe the machine cuts off and screws up the fitting. The gears are completely incased and run in oil. The machine is driven by a ¼-hp. Westinghouse motor and can be run from an ordinary light socket.

Electric Range.—A single oven range of small and compact size, known as the Junior Automatic Electric Range and made in both black japanned and white vitreous enamel finish, has been designed by the Westinghouse Electric & Manufacturing Company. The new range, as its name implies, is fully automatic in operation. The oven, which is made of sheet steel and finished both inside and out with a heavy coat of blue vitreous enamel, is thoroughly insulated. It is 14 in. x 14 in. and 17½ in. deep and is heated with two 1,500-watt units of the open brick type. The three surface units are also of the open brick type and consist of one 8-in. 1,500-watt, one 8-in. 1,000-watt and one 6-in. 1,000-watt element. The units are controlled by three-heat reciprocating snap switches.

Safety Switch. — A compact safety switch, 8 in. high, 5¼ in. wide and 4½ in. deep, primarily for use with small motors, has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. The fuse block, which is mounted over the switch base so that the fuses are readily accessible, is easily reversible, so that the line leads can be brought in either at the top or bottom of the switch. The switch is provided with quick make and brake and with "type A" interlock. The construction is of the "dead-front" type, a shield being used to cover the line terminals. The switches are furnished fused or unfused two-pole or three-pole for 250-volt service, but 440-volt and 550-volt, two-pole and three-pole switches will soon be placed on the market.





AT LEFT—"AUTO U-RE-LITE W" WITH COVER REMOVED, SHOWING BARRIERS AND OVERLOAD COILS WITH TIME-LIMIT FEATURE. AT RIGHT—"AUTO U-RE-LITE W" WITH COVER ON

New Trade Literature

POLYPHASE MOTORS. — Bulletin No. 35 issued by the Century Electric Company, St. Louis, describes the "Century" squirrel-cage induction polyphase motors, type "SC," which are manufactured in sizes from ½ hp. to 75 hp.

HEATER.—The Buffalo Forge Company, Buffalo, has published a bulletin describing and illustrating its "Breezo-Fan" heater for use in power plants, industrial plants, etc. Attention is also called to the "Mercoid" thermostat for automatic room-temperature regulation.

AMPERE-HOUR METERS. — The Sangamo Electric Company, Springfield, Ill., is distributing a bulletin describing and illustrating the "Sangamo" ampere-hour meters for train-lighting systems.

WIRING DEVICES, ETC.—A new catalog, known as publication No. 3,131, has been issued by the Cutler-Hammer Manufacturing Company, Milwaukee, covering the "C-H" wiring devices and specialties. It also includes descriptions and listing of radio rheostats, potentiometers, switches, resistance units, etc., manufactured by the company.

FLOODLIGHTS AND PROJECTORS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing folder No. 18, covering the "Imperial" floodlights and projectors. Bulletin No. 2,062 issued by the company describes its "Mogul" series of condulets.

BATTERIES.—The Universal Battery Company, 3,410 South La Salle Street, Chicago, has issued bulletin No. 75-C, describing the Universal "Nu-Seal" batteries for power and light plants and radio outfits.

ELECTRIC TRUCKS.—The Commercial Truck Company, 300 Hunting Park Avenue, Philadelphia, has issued a booklet entitled "Hit from Where Your Hand Is," which it designates as an elementary course in fighting for electric truck business. It contains "no charts, no statistics—just facts," showing the superiority of electric trucks for general service.

ACORNS, RECEPTACLES, ETC.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued bulletins Nos. 71-13-A and 17-22-A, covering the Hubbell" luminous (detachable) acorns and porcelain receptacles respectively.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Quebec, Canada (No. 11,436), of storage-battery parts.

An agency is desired in Vienna, Austria (No. 11,432), for electrical supplies.

An agency is desired in Bahia, Brazil (No. 11,413), for electrical supplies.

An agency is desired in London, England (No. 11,412), for household electrical appliances and electrical repair parts.

Purchase is desired in Corinto, Nicaragua (No. 11,428), of self-contained lighting plants.

Purchase is desired in Jubbulpore, India (No. 11,493), of self-contained lighting plants.

Purchase is desired in Weltevreden, Java (No. 11,435), of small lighting plants, driven by waterwheels.

Purchase is desired in Rome, Italy (No. 11,431), of 10-hp. motors for motor buses.

An agency is desired in Lugano, Switzerland (No. 11,429), for radio apparatus (head telephones).

Purchase is desired in Montreal, Canada (No. 11,437), of radio apparatus and parts.

Purchase is desired in Amsterdam, Netherlands (No. 11,434), of radio apparatus and supplies.

Purchase and agency is desired in Medan, Sumatra (No. 11,438), for radio receiving sets.

Purchase is desired in Madrid, Spain (No. 11,430), of refrigerating machinery and equipment for cafés, restaurants and hotels.

Purchase is desired in Hankow, China (No. 11,433), of transformers and extra switchgear and other gear for equipment of transformer stations.

Purchase and agency are desired in Melbourne, Australia (No. 11,443), for metallurgical machinery, furnaces, appliances, pyrometers and other instruments; also a steel-conduit pipe-manufacturing machine (No. 11,449).

Purchase is desired in Montevideo, Uruguay (No. 11,456), of brass and copper sheets, bars and wire.

GALVANIZED IRON WIRE AND BLACK MALLEABLE WIRE FOR MONTEVIDEO, URUGUAY.—Tenders will be received by the State Electric Works, Montevideo, Uruguay, until Oct. 9 for 11,000 kg. of galvanized-iron wire and for 25,000 kg. of black malleable-iron wire.

ELECTRIC CRANE AND STEAM TRAVELING CRANES FOR ARGENTINA.—Tenders will be received by the Ministry of Public Works, Buenos Aires, Argentina, until Oct. 27 for one stationary electric crane and twenty-five steam traveling cranes.

INCANDESCENT ELECTRIC LAMPS FOR SOUTH AFRICA.—Tenders are being asked (no date) by the South African Railways and Harbors Board, Cape Town, South Africa, for incandescent lamps.

New Incorporation

THE BALDWIN COUNTY LIGHT & POWER COMPANY, Fairhope, Ala., has been incorporated for the purpose of building an electric plant to supply electricity to towns along the eastern shore of Mobile Bay. The officers are: G. R. Wood, president; Walter Roberts, vice-president, and O. K. Cummings, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 9, for 50,000 weatherproof sockets for the local navy yard (Schedule 2607).

SUNAPEE, N. H.—The New Hampshire Power Company has issued $252,000 in capital stock, part of the proceeds to be used for extensions and improvements.

BOSTON, MASS. — The Edison Electric Illuminating Company has filed plans for the erection of a one-story substation at 19-27 Scotia Street.

Middle Atlantic States

BINGHAMTON, N. Y.—Application has been made by the Binghamton Light, Heat & Power Company to the Public Service Commission for authority to erect four transmission lines from its main power station at Crocker Island to sections which it plans to serve and to tie in with the lines of the Cortland (N. Y.) County Traction Company for an exchange of power. The proposed Greene-Smithville line will serve the towns of Braker, Chenango, Greene, Smithville, German, McDonough, Pharsalia and Lincklaen. The Cortland line extends through the town and village of Marathon and the towns of Virgil and Cortlandville to connect with the southern terminus of a proposed transmission line of the Cortland County Traction Company. The Cincinnatus line, taking its power from the Cortland line, will supply service to Willett, Cincinnatus, Taylor and Pitcher. To supply electricity to the towns of Owego, Tioga, Newark Valley, Berkshire and Richford and the village of Newark Valley it is proposed to use the Newark Valley-Berkshire-Richford line. The Binghamton company has also applied for permission to merge with the Owego (N. Y.) Light & Power Company, which it now owns.

BRONXVILLE, N. Y.—The Lawrence Park Heat, Light & Power Company has applied to the Public Service Commission for authority to exercise a franchise granted by the Bronxville authorities to extend its electric light and power and heating service from a point in New Street along Sagamore Road and Prescott Avenue, where the Lawrence Investing Company proposes to erect a group of community houses for the purpose of furnishing service to these new buildings.

BROOKLYN, N. Y. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 9, for forty electric sterilizers and twenty heating elements (Schedule 2611).

BROOKLYN, N. Y. — The Brooklyn-Manhattan Corporation plans to install new oil switches and make other improvements to its Williamsburg power plant, involving an expenditure of about $500,000.

BUFFALO, N. Y.—Bids will be received by William F. Schwartz, Commissioner of Public Works, Municipal Building, until Sept. 15, for one electric freight elevator for head house at the new municipal filter plant and one 10-ton electric traveling crane, three motor, pendant-operated. Plans are on file at the office of George C. Andrews, engineer, filtration division, Municipal Building.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has applied to the Public Service Commission for authority to erect and operate a transmission line through the town of Sullivan under terms of a franchise granted by the Town Board.

FORT EDWARD, N. Y.—The Adirondack Power & Light Company has applied for a franchise here for light and power service and proposes to extend its transmission lines and install a local system.

KENMORE, N. Y.—Bids will be received by the Town Board of the Town of Tonawanda, Village Hall, Kenmore, until Sept. 8 for lighting standards. George C. Diehl, 577 Ellicott Square, Buffalo, is engineer.

LAURELTON, N. Y.—The Long Island Railroad Company has taken out a permit to erect a substation, at Lincoln Avenue and 207th Street, to cost about $23,000.

NEW YORK, N. Y.—Bids will be received at the Department of Purchase of the City of New York, Room 526, Municipal Building, until Sept. 11 for furnishing lamps, electrical material and supplies to the Police Department and the Departments of Correction, Plant and Structures and Water Supply, Gas and Electricity for the period ending Dec. 31, 1924. John E. Bowe is commissioner.

ROCHESTER, N. Y.—Plans for the proposed new Municipal Hospital on Elmdorf Avenue, to cost about $250,000, include a power and heating plant. Gordon & Kaelber, Rochester, are architects.

SCIO, N. Y.—The Genesee Valley Power Company, Fillmore, has petitioned the Public Service Commission for an approval of a franchise granted by the town of Scio to furnish electricity here. It plans to extend its lines from Belmont to Scio, a distance of 5 miles, to furnish electricity to residents along the proposed line. The cost of the transmission line and distribution system is estimated at $12,000.

ALLENHURST, N. J.—The Eastern New Jersey Power Company, recently organized, is reported to be negotiating for the purchase of the electric plants at Brown's Mills, New Egypt and Allentown. The company has purchased the plants at Hightstown and Jamesburg and contemplates extending its service to Medford and Vincentown.

MADISON, N. J.—The Borough Council is considering the installation of an improved lighting system on Main Street.

EASTON, PA.—The Bath (Pa.) Portland Cement Company, plans to build a power plant at its proposed mill at Sandt's Eddy, about 6 miles from Easton, to cost about $1,500,000. The plant will be equipped throughout with electrically operated machinery. Contract has been let to the Public Service Production Company, Newark, N. J., for designing, erecting buildings and the purchase and installation of equipment.

PHILADELPHIA, PA. — The Gorgas-Pierie Manufacturing Company, foot of Bigler Street, manufacture of cocoanut-oil products, plans to install electric power equipment in connection with the proposed rebuilding of its plant, recently damaged by fire with loss of about $500,000.

SHIPPINGPORT, PA.—The Duquesne Light Company, Pittsburgh, is planning to build a large generating plant at Shippingport, to cost about $10,000,000. Included in the project is the removal of the Junction Park substation to a new location in Rochester Township, where a site of eleven acres has been acquired.

WASHINGTON, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 16 for conduit and wiring, lighting changes, etc., at the United States post office at Washington. For details see searchlight section.

BALTIMORE, MD. — The Pennsylvania Water & Power Company has plans for

the construction of a steel-tower transmission line from its local Highlandtown substation to its switching station at Gunpowder, about 18 miles. The work will be carried out by the Susquehanna Transmission Company, a subsidiary organization.

BALTIMORE, MD. — The Bethlehem Steel Company plans to install electric power equipment in connection with extensions at its Sparrow Point tinplate mills, to cost about $3,000,000.

BALTIMORE, MD.—Preparations are being made by the Consolidated Gas, Electric Light & Power Company for the construction of a steam-operated generating plant on Gould Street. The plans provide for an initial capacity of 60,000 hp., to cost about $4,000,000, eventually the output will be increased to 140,000 hp., with an additional cost of $5,000,000.

BRISTOL, VA.—At an election held recently the voters approved the contract with the Edmundson Power & Electric Company to supply light and power in Bristol. The company plans to build a dam on the south fork of Holston River at Avan's Ford, about 14 miles from Bristol. Transmission lines will be erected to the city and a local distribution station built.

COVINGTON, VA.—The Hollingsworth & Vost Company, 141 Mill Street, Boston, contemplates the construction of a power house at its proposed local paper mill. The cost of plant is estimated at $1,000,000.

PORTSMOUTH, VA. — Bids, it is reported, will soon be asked for extension to the ornamental lighting system on Middle Street.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 8, for 296 dynamotor units, 75 plugs and sockets, 60 condensers, 25 relays and 45 plugs without sockets (proposal CP 18073-3).

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Government Printing Office, until Sept. 8 for furnishing and installing an electric crane and hoist.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Sept. 9 for two motor-generators and starters complete (Schedule 2612).

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Sept. 10 for a quantity of electrical equipment, including resistance wire, outlet boxes, semi-direct fixtures, gong electric bells, etc. (Panama Circular 2359).

North Central States

CARO, MICH.—The Great Lakes Power Company is reported to be considering the erection of a high-tension transmission line from Sandusky to Wilmot.

LEXINGTON, MICH.—G. C. Hanson & Company have contracted with the municipality to purchase power for service along the lake shore and will build a transmission line to the municipal plant.

MENOMINEE, MICH.—Steps have been taken by the business men and property owners along Sheridan Road and Ogden Avenue to secure an ornamental lighting system in the business section of the city.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Sept. 12 for paper-insulated, lead-covered cable for the division of light and power.

PITTSBURG, KY.—The Kentucky Utilities Company is perfecting plans for the construction of a transmission line here for local light and power service.

CROWN POINT, IND.—The Cummings Vote Registering Machine Company, Knox, contemplates the construction of a power house at its proposed local plant, to cost about $300,000.

EAST CHICAGO, IND.—The Superheater Company will soon begin work on the erection of a power house at its plant. Railroad Avenue and 151st Street, to cost about $50,000. Contract for steel superstructure has been awarded.

EVANSVILLE, IND. — The Southern Indiana Gas & Electric Company is considering issuing $500,000 in capital stock, part of the proceeds to be used for extensions and improvements.

HUNTINGTON, IND.—Plans, it is reported, are under consideration for increasing the capacity of the power plant of the Huntington Light & Fuel Company, to cost about $500,000.

PORT WING, WIS.—Plans are being considered by the Northern Wisconsin Hydro-Electric Power Company to increase the output of its plant. The work includes increasing the head of the dam from 38 ft. to 70 ft., which will practically double the output of the power station. Two generating units, one of 500 hp. and the other 1,000 hp., will be installed. Nothing will probably be done before 1925.

DETROIT, MINN.—The Council has adopted an ordinance authorizing a bond issue of $50,000 for improvements to the municipal electric light and power plant.

MINNEAPOLIS, MINN. — The Council has authorized the installation of sixty-three new electric street lamps this year.

SPRINGFIELD, MINN.—The installation of an ornamental lighting system is under consideration by the City Council. Ralph W. Richardson, St. Paul, is engineer.

BELLEVUE, IOWA. — The Henry G. Johnson Piano Company, it is reported, plans to build a power house at its proposed factory, to cost about $150,000, to replace a plant recently destroyed by fire.

KEOSAQUA, IOWA.—The Iowa Electric Company has acquired the municipal electric light plant and plans to extend its transmission line for local service.

NORTH WASHINGTON, IOWA.—The citizens have voted to establish a municipal electric lighting system. Electricity will be secured from the Consumers Power Company, Osage, which will extend its transmission line from Alta Vista to furnish the service.

MEXICO, MO.—The Public Service Commission has granted the Missouri Power & Light Company permission to issue $1,200,000 in certificates, part of the proceeds to be used for extensions and improvements.

NEVADA, MO.—The Public Service Commission has authorized the West Missouri Power Company to issue $220,500 in capital stock and $870,000 in bonds, to purchase the property of the Fort Scott & Nevada Light, Heat, Water & Power Company, which will be consolidated with the system of the West Missouri company.

NEW FRANKLIN, MO.—The property of the New Franklin Electric Company has been acquired by the Missouri Power & Light Company, Mexico, which plans to erect a transmission line from Boonville to New Franklin.

REPUBLIC, MO.—At an election held recently the proposal to purchase electricity from the Lawrence County Water, Light & Cold Storage Company, Aurora, to operate the local system was carried. The project includes rebuilding the local distribution system and installing a new street-lighting system. It is proposed to double the number of street lamps now in use.

FLANDREAU, S. D.—The Town Council is planning to build a municipal hydro-electric plant. Chenoweth & Rettinghouse, Paulton Block, Sioux Falls, are engineers.

KEYSTONE, S. D.—The Keystone Arsenic Company plans to build a steam-driven electric power plant for service at its mill and mining properties, to cost about $42,000.

LINCOLN, NEB.—The State Railway Commission has granted the University of Nebraska permission to erect a transmission line from the village of Bethany to the agronomy farm, which is under the control of the university, to supply electricity for light and power purposes.

Southern States

MAYSVILLE, N. C.—The Town Council plans to install a municipal electric lighting system, for which bonds have been authorized.

ROBERSONVILLE, N. C.—The electric light plant of the Light & Mill Company was recently destroyed by fire. At present the town is without electrical service. B. F. Coburn is manager.

RUTHERFORD, N. C.—The People's Ice & Fuel Company is planning to install new equipment at its plant and will purchase a 150-hp. generator, direct-connected to oil engine, and accessories.

ALBANY, GA.—Among the improvements contemplated by the Georgia-Alabama Power Company this year, to cost about $100,000, is included the installation of a 2,750-kw. generator and accessories at its Flint River power station near here.

FORT MEADE, FLA.—The City Council is considering the installation of an ornamental lighting system in the business district.

EUFAULA, ALA. — The Consumers Power Company, recently organized, is said to be planning the erection of a transmission line. A. L. Crouch heads the company.

SELMA, ALA.—The installation of an ornamental lighting system on Broad and Water Streets is under consideration, and surveys are being made by the Alabama Power Company.

JACKSON, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 15 for remodeling the electric passenger elevator in the United States postoffice and custom house, Jackson. For details see Searchlight Section.

WATER VALLEY, MISS.—The installation of an ornamental lighting system is under consideration by the City Council.

WALNUT RIDGE, ARK.—The Central Power & Light Company is arranging an expansion and betterment program to be carried out during the next two years, to cost about $800,000.

JENNINGS, LA.—The Louisiana State Rice Milling Company contemplates rebuilding its local power house, used by the Industrial Irrigation Company, recently destroyed by fire with loss of about $50,000.

LAKE CHARLES, LA.—The Eastern Texas Electric Railway Company, Beaumont, has acquired the property of the Lake Charles Railway, Light & Water Company. Extensions, it is understood, are contemplated.

BRAMAN, OKLA.—Plans are under consideration for construction of new waterworks, mains, etc., the erection of electric transmission line from Blackwell and the installation of a street-lighting system here, to cost about $30,000.

OKLOHOMA CITY, OKLA.—The United Power Company, recently chartered with a capital of $100,000, plans to erect a transmission line in the vicinity of Pond Creek, where franchises have been secured in a number of communities. Calvin A. Jones, 619 East Ninth Street, Oklahoma City, heads the organization.

VERNON, TEX.—Bids, it is reported, will be received by the city of Vernon until Sept. 9 for the installation of a water and light plant. The equipment will include one 300-hp. oil-burning engine directly connected to 2,300-volt, three-phase, 60-cycle generator, exciters, switchboard, etc.

WACO, TEX.—The Council is considering installing additional ornamental street lamps in different sections.

Pacific and Mountain States

TACOMA, WASH.—The City Council has authorized Ira S. Davisson, commissioner of light and water, to call for bids for cranes, hoists, switches and switchboards, to cost about $80,000.

CATHLAMET, WASH. — The Crown-Willamette Paper Company, Pittock Building, Portland, it is reported, contemplates building a paper mill in this section, with power house to furnish electricity to operate the plant. The cost is estimated at $500,000.

PILOT ROCK, ORE.—Negotiations have been closed between the City Council and the Pacific Power & Light Company, Portland, whereby the later will take over the municipal distribution system and furnish electrical service to the town. The company plans to erect a 6,600-volt transmission line from its substation at Pendleton, a distance of 20 miles, to furnish electricity here.

PORTLAND, ORE.—The Northwestern Electric Company is adding 2,000 boiler horsepower to its Lincoln steam plant, is installing a 10,000-kva. synchronous condenser and is making extensions to the general distribution system, at a cost of $750,000. The company is also investigating new power sites on Lewis River, Wash. L. T. Merwin is vice-president and general manager.

ANAHEIM, CAL.—The Board of City Trustees is planning to call a special election to vote on the proposal to issue $240,000 in bonds for the construction of a municipal electric power plant.

DIXON, CAL.—The Mount Shasta Power Company plans extensions to its local substation, known as the Vaca-Dixon substation, including the installation of additional equipment. A synchronous condenser of 40,000 kva. rating will be furnished by the Westinghouse Electric & Manufacturing Company.

FULLERTON, CAL.—The Board of City Trustees has authorized preliminary plans and estimates of cost for a municipal electric light and power station. W. C. Record is city engineer, in charge.

LOS ANGELES, CAL.—Eighteen permits have been issued by the State Division of Water Rights to the Southern California Edison Company covering hydro-electric development in practically the entire San Joaquin watershed above 1,000-ft. altitude. The total eventual cost is estimated at $200,000,000.

LOS ANGELES, CAL.—The Council has authorized the installation of an ornamental lighting system on Flower Street, comprising sixty-two pressed-steel standards; on Glenhurst Avenue, eleven concrete standards; on Wilcox Avenue, twenty pressed-steel standards, and on Deane and La Brea Avenues, twenty-one and thirty concrete standards respectively.

POMONA, CAL.—The Board of City Trustees is considering the installation of an electric fire alarm system.

RIVERSIDE, CAL.—The Nevada-California Power Company has secured permission to use waters from the North Fork Rush Creek for a hydro-electric plant to develop about 5,000 hp. The cost is estimated at $160,000.

SAN FANCISCO, CAL.—Plans are under consideration by the Pacific Gas & Electric Company for the construction of several substations in the East Bay section, to cost about $4,000,000. The construction of a substation at Antioch, to cost about $1,000,000, is included in this program.

SANTA BARBARA, CAL.—The City Council has authorized the installation of an ornamental lighting system on Carillo Street, using cast-iron standards.

SANTA MONICA, CAL.—The Board of City Trustees has authorized the installation of an ornamental lighting system on Main Street, using concrete standards. Howard B. Carter is city engineer, in charge.

WATSONVILLE, CAL.—The Union Ice Company, 354 Pine Street, San Francisco, plans to build a local ice manufacturing and cold-storage plant, to cost from $350,000 to $500,000.

DELTA, UTAH. — The Deseret Power Company will install an additional transformer of 150 kw. capacity at its substation and increase its power load by 200 kw. H. A. Lawrence is lessee and manager.

SPRINGVILLE, UTAH.—Plans are under consideration to install an additional generating unit (possibly 200 kw.) in the municipal electric plant next year. William N. Grooms is superintendent.

VERNAL, UTAH.—The Vernal Milling & Light Company is erecting 3 miles of 2,300-volt line to its local distribution system. James C. Anderson manager of electrical department.

GLENDIVE, MONT.—Bids will be received by the city clerk until Sept. 11 for oil-engine generator set, with accessory equipment, for municipal service. Louis P. Wolff, Globe Building, St. Paul, Minn., is engineer.

WHEATLAND, WYO.—Work will soon begin on the erection of an electric transmission line from the government plant at Lingle to Wheatland, a distance of 70 miles, to supply electricity for the municipal electric plant. A. J. Loftus is manager of the municipal plant.

Canada

WINNIPEG, MAN.—Tenders will be received by the chairman of committee of Public Utilities at the office of C. J. Brown, city clerk, until Sept. 15 for furnishing street-lighting fixtures, regulating transformers, automatic cut-outs, electrodes and glassware, to be delivered at the May Street substation. Specifications may be obtained at the office of the city of Winnipeg Hydro-Electric System, 55 Princess Street.

CHIPPEWA, ONT.—Plans are under way by the Canadian Niagara Power Company for the erection of transmission lines along the Niagara Boulevard between Chippewa and Bridgeburg, to supply electricity in that section. The cost is estimated at about $25,000.

LEVIS, QUE.—The National Telephone Company, Ltd., has appropriated $250,000 for extensions to its system, including a new long-distance telephone line.

SHAWINIGAN FALLS, QUE.—A special meeting of the stockholders of the Shawinigan Falls Water & Power Company will soon be held to vote on the proposal to increase the capital stock from $20,000,000 to $25,000,000.

MOOSE JAW, SASK. — The proposed $150,000 debenture bylaw for extensions to the municipal electric light and power plant has been defeated by the ratepayers.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 29, 1924)

1,502,828. OVERHEAD-TROLLEY SYSTEM; O. M. Jorstad, East Pittsburgh, Pa. App. filed April 7, 1922. Having relatively long distances between supporting towers or structures.

1,502,829. INSULATED STRAIN ROD; W. H. Kempton, Wilkinsburg, Pa. App. filed March 13, 1918.

1,502,831. SYSTEM OF CONTROL; S. M. Kintner, Pittsburgh, Pa. App. filed May 11, 1921. In radio-telegraphy signaling systems employed in connection with arc-converter systems.

1,502,836. RAIL BOND; M. H. Loughridge, Bogota, N. J. App. filed Aug. 9, 1919. Secondary contacts avoided where bonds are secured to the rails.

1,502,840. ELECTRIC CLOCK; C. L. Beard, Chester, Pa. App. filed Sept. 30, 1921. Secondary clock controlled by a master clock.

1,502,848. TUNING SYSTEM OF ANTENNAS; F. Conrad, Pittsburgh, Pa. App. filed July 7, 1920. By introduction of reactances into the antenna circuit to obtain selectivity.

1,502,860. VARIABLE CONDENSER; D. S. McCrum, Saranac Lake, N. Y. App. filed Nov. 24, 1923. Composed of a plurality of concentric cylindrical aluminum plates or cylinders.

1,502,874. TRANSFORMER FRAME; J. F. Peters, Pittsburgh, Pa. App. filed Dec. 10, 1919. Arranged to prevent the leakage flux from entering it.

1,502,875. TONE-PRODUCING RADIO RECEIVER; M. I. Pupin, Norfolk, Conn. App. filed Feb. 10, 1916.

1,502,877. AUTOMATIC TELEPHONE SYSTEM; A. J. Ray, Chicago, Ill. App. filed Feb. 23, 1921. Where multi-party lines are employed and where the lines are provided with repeating coils individual thereto.

1,502,889. METHOD OF AND SYSTEM FOR RADIO SIGNALING; H. J. van der Bijl, Pretoria, South Africa. App. filed Jan. 8, 1918. Whereby messages are transmitted as modulations of a high-frequency carrier wave.

1,502,907. X-RAY DEVICE; W. D. Coolidge, Schenectady, N. Y. App. filed June 30, 1919. X-ray tube with thick glass walls to prevent noisy operation.

1,502,909. ASYNCHRONOUS MOTOR; F. Deflassieux, Paris, France. App. filed Sept. 3, 1921. With star-delta, series-parallel arrangement of winding for starting.

1,502,913. TOWER INDICATOR; R. C. Leake, Rochester, N. Y. App. filed July 7, 1919. Indicating relays used in railway signaling.

1,502,916. AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed July 23, 1919. Machine switching.

1,502,917. INTEROFFICE TRUNKING SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Dec. 4, 1920. For telephonic communication.

1,502,924. INDUCTIVE STATIC DRAIN FOR OIL-STORAGE TANKS; C. A. Stanley, Wichita, Kan. App. filed Nov. 21, 1921.

1,502,928. STORAGE-BATTERY TESTER; J. L. Thompson, Greensburg, Pa. App. filed July 15, 1920.

1,502,931. DYNAMO-ELECTRIC MACHINE; F. P. Whitaker, Rugby, England. App. filed Nov. 1, 1920. Using a special winding to improve commutation.

1,502,932. ELECTRIC HEATER; W. L. Young, Fort Wayne, Ind. App. filed June 30, 1921. For heating tools and other metallic articles.

1,502,934. MEANS FOR TESTING TRACK CIRCUITS; A. B. Barnett, Roanoke, Va. App. filed Dec. 10, 1923.

1,502,938. INSULATED COUPLING FOR ELECTRIC FIXTURES; F. L. Butler, Chicago, Ill. App. filed Jan. 19, 1922.

1,502,940. AUTOMOBILE DIRECTION INDICATOR; H. T. Cox, Long Beach, Cal. App. filed April 8, 1921.

1,502,958. DEVICE FOR DRIVING SHAFTS AT A LOW AND UNIFORM SPEED BY AN ELECTRO-MOTOR; C. Lott, Horgen, Switzerland. App. filed June 15, 1922. As applied to driving a phonograph disk.

1,502,980. SPOOL CONSTRUCTION; C. H. Cuno, Meriden, Conn. App. filed June 9, 1922. For use with extension cords.

1,503,006. ILLUMINATED TOP; P. J. Rause, South Orange, N. J. App. filed Nov. 21, 1923.

1,503,010. INDICATING SIGNAL FOR VEHICLES; A. C. Schroeder, Syracuse, N. Y. App. filed Dec. 28, 1920.

1,503,060. STORAGE BATTERY; W. B. Osborne, Elma, N. Y. App. filed Nov. 22, 1920. Having the plates normally supported by the cover of the container in which they are placed.

1,503,070. STORAGE BATTERY; A. H. Snyder, Lancaster, N. Y. App. filed Nov. 22, 1920. In which both sets of plates are suspended in the container supported by a cover of antimony lead alloy.

1,503,073. INSULATED CONNECTOR; L. Steinberger, Brooklyn, N. Y. App. filed May 5, 1919. Bushing type with conductor molded axially therein.

1,503,085. REGULATOR; E. J. Blake, Buffalo, N. Y. App. filed Oct. 9, 1920. Of the type used as a lamp regulator on systems receiving a variable voltage.

1,503,090. ELECTROMAGNET; E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 27, 1920. As used for operating switches.

1,503,095. TELEPHONE SYSTEM; H. D. Currier, Chicago, and G. R. Eaton, Oak Park, Ill. App. filed Feb. 24, 1919. Manual switchboard type.

1,503,096. CALL-DISTRIBUTING SYSTEM; H. D. Currier, Chicago, and G. R. Eaton, Oak Park, Ill. App. filed June 23, 1919. Employing both manual switchboards and automatic apparatus.

1,503,098. STORAGE BATTERY; T. B. Entz, New York, N. Y. App. filed Dec. 28, 1920. Plates supported from the cover of the cell with their free ends supported by the terminal ends of plates of opposite polarity by means of insulating members.

1,503,108. AUTOMOBILE SIGNAL; F. Bauer, Milwaukee, Wis. App. filed Jan. 27, 1922. Direction signal.

1,503,130. ELECTRICAL APPARATUS FOR AUTOMATICALLY CONTROLLING PEAK DEMANDS; E. T. Moore, Syracuse, N. Y. App. filed Feb. 14, 1920. Of a plant employing electric furnaces.

1,503,156. MOTOR-CONTROL SYSTEM; J. H. Hall, Cleveland Heights, Ohio. App. filed July 13, 1922. For motor accleration.

1,503,213. MOTOR CONTROLLER; E. R. Stoekle, Milwaukee, Wis. App. filed May 15, 1919. For induction motors, obviating the necessity of using switches.

1,503,214. VIBRATING REGULATOR; R. H. Sullivan, Rochester, N. Y. App. filed April 17, 1922. Voltage regulator.

1,503,224. PORTABLE ANTI-OFFSET DEVICE; J. R. Blaine, Oak Park, Ill. App. filed March 28, 1921. Printing presses.

1,503,226. HOLDING ATTACHMENT FOR SOUND RECEIVERS; C. W. Burrows, New York, N. Y. App. filed March 11, 1922.

1,503,235. CABLE END BELL; F. E. Getts, Chicago, Ill. App. filed April 2, 1918.

1,503,238. ELECTRIC CONNECTING DEVICE EOR FLOATING OR SUBMARINE VESSEL; F. Gall, Kiel, Germany. App. filed Aug. 31, 1921.

1,503,243. TELEPHONE RECEIVER; O. M. Leich, Genoa, Ill. App. filed June 2, 1922. With a sheet-metal cap.

1,503,245. MOTOR CONTROLLER; H. P. Reed, Milwaukee, Wis. App. filed March 23, 1917. For two-speed elevator motor.

1,503,250. APPARATUS FOR AND METHOD OF RAPID TRANSMISSION OF TELEGRAPHIC MESSAGES; P. E. Sabine and W. F. Friedman, Geneva, Ill. App. filed Aug. 7, 1920.

1,503,252. TELEPHONE SYSTEM; W. G. Shull, Chicago, Ill. App. filed Jan. 29, 1921. Multiple-line lamp system.

1,503,254. ARMATURE-WINDING MACHINE; E. H. Sippel and H. H. Hager, Toledo, Ohio. App. filed Aug. 14, 1920.

1,503,272. COIL-WINDING MACHINE; J. A. Lewellyn, Toledo, Ohio. App. filed April 28, 1919.

1,503,275. INTERCHANGEABLE SUPPORT FOR ELECTRIC FIXTURES; H. D. McFaddin, East Orange, N. J. App. filed March 7, 1921.

1,503,284. HIGH-POTENTIAL ELECTRICTY ARRESTER; F. R. Parker Chicago, Ill. App. filed March 8, 1907. Lightning arrester.

1,503,285. PROCESS OF PRODUCING UNIFORM VOLTAIC CELLS; F. R. Parker, Chicago, Ill. App. filed May 8, 1916.

1,503,306. PLUG ATTACHMENT; F. Dominick, New York, N. Y. App. filed March 23, 1922.

1,503,308. METHOD OF AND APPARATUS FOR ELECTRICALLY TRANSMITTING INTELLIGENCE; C. D. Ehret, Philadelphia, Pa. App. filed Oct. 22, 1920.

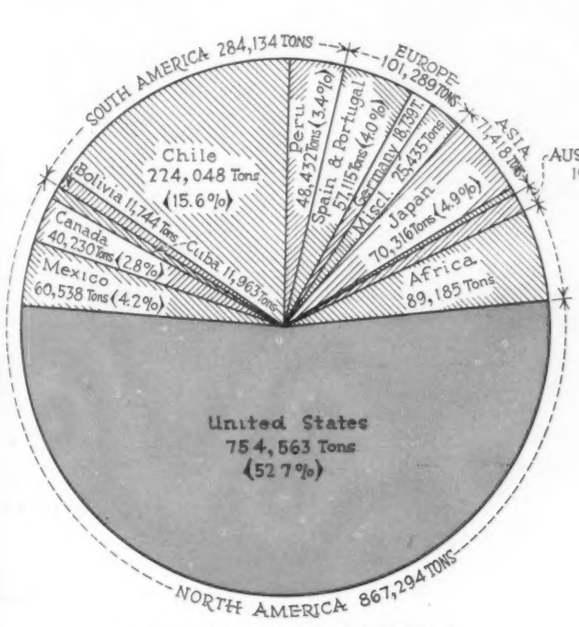
1,503,311. CAR DISCHARGE VALVE AND SIGNAL SWITCH; C. C. Farmer, Edgewood, Pa. App. filed March 31, 1921. Adapted for use on railway trains.

1,503,315. ELECTRIC WELDING; J. F. Gall, Evanston, Ill. App. filed April 28, 1919 Butt-welding.

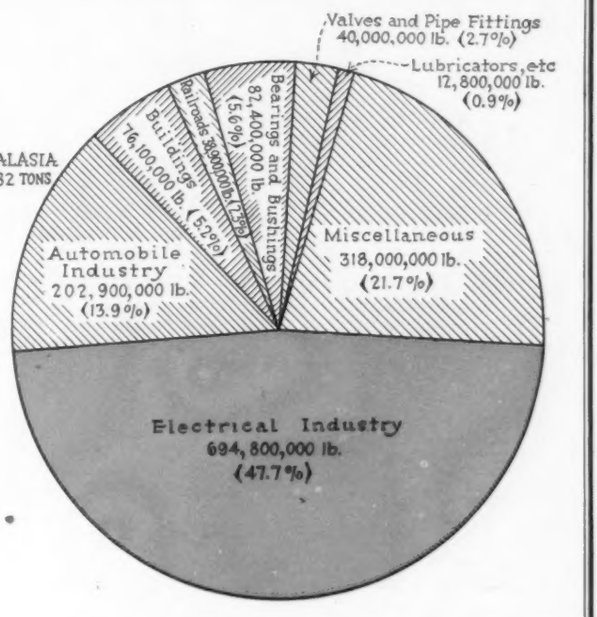
1,503,324. MEANS FOR PRODUCING ELECTRIC OSCILLATIONS BY AN ELECTRIC ARC; R. Herzog, Berlin, Germany. App. filed July 12, 1920.

Business Facts for Electrical Men

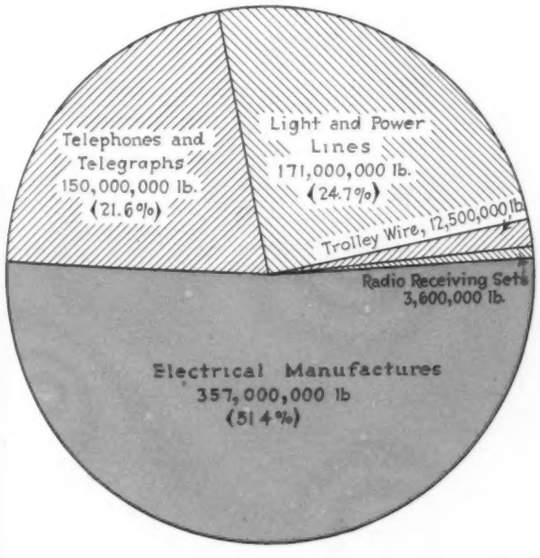
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business



WORLD PRODUCTION OF COPPER
1,433,102 SHORT TONS
(1923)


Valves and Pipe Fittings 40,000,000 lb. (2.7%)
Lubricators, etc 12,800,000 lb. (0.9%)
Bearings and Bushings 82,400,000 lb. (5.6%)
Railroads 38,900,000 lb. (2.7%)
Buildings 76,100,000 lb. (5.2%)
Automobile Industry 202,900,000 lb. (13.9%)
Miscellaneous 318,000,000 lb. (21.7%)
Electrical Industry 694,800,000 lb. (47.7%)

COPPER CONSUMPTION IN UNITED STATES
1,465,900,000 LB.
(1923)


Telephones and Telegraphs 150,000,000 lb. (21.6%)
Light and Power Lines 171,000,000 lb. (24.7%)
Trolley Wire, 12,500,000 lb.
Radio Receiving Sets 3,600,000 lb.
Electrical Manufactures 357,000,000 lb (51.4%)

COPPER CONSUMPTION BY ELECTRICAL INDUSTRY
694,800,000 LB
(1923)

Copper Production Reflects Prosperous Conditions in the Electrical Industry

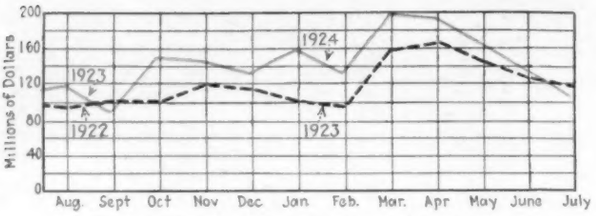
THERE are, as a rule, several barometers which indicate the prevalent economic conditions within an industry. All industry is so interdependent with other industries that activity within one is, as a rule, reflected in activity in one or all the others. This reflection is, of course, dependent upon the degree to which two industries so compared are dependent upon each other. An instance of this is to be found in the relationship between the electrical and the copper industries. The electrical industry uses copper in the manufacture of its generating equipment, in its transmission and distribution equipment, and in the apparatus which ultimately consumes the generated energy. Seldom can an instance be found of two distinct industries more intimately related. What affects one affects the other immediately.

A direct reflection of the expansion which took place in the electrical industry during 1923 is to be found in the greatly increased amount of copper consumed by that industry. In 1922 the electrical industry as a whole consumed 499,300,000 lb. of copper, while in 1923 this consumption had increased to 694,800,000 lb., a 39 per cent growth. The increased copper consumption was distributed almost evenly between the manufacture of generators, motors, switchboards, lamps, etc., and the extensions to the transmission and distribution systems of the country. Almost 48 per cent of the total copper consumption in the United States during 1923 was used by the electrical industry.

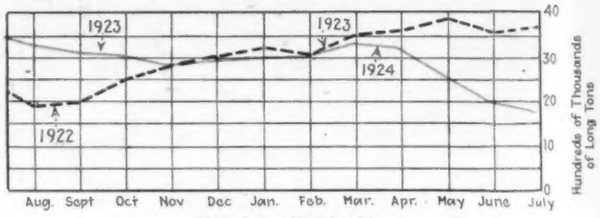
The United States easily leads the world in copper production, with 1,509,126,000 lb., or about 63 per cent of the total world production. Chile follows with 448,096,000 lb., or 16 per cent of the total.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

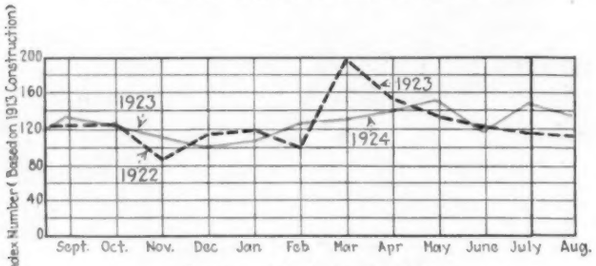
How the Primary Industries Are Trending



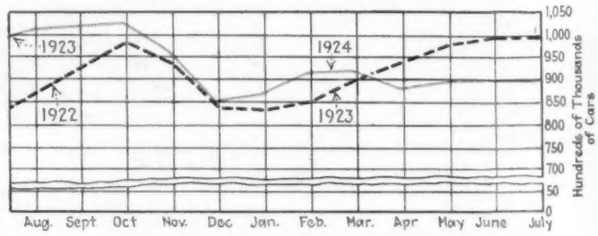
Contracts Awarded for Residential Buildings



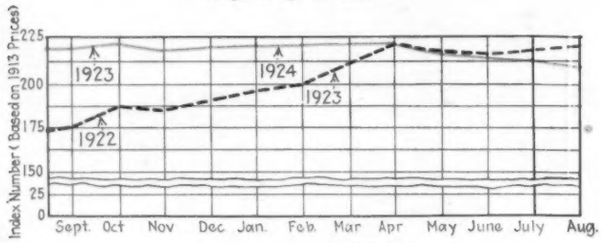
Pig-Iron Production



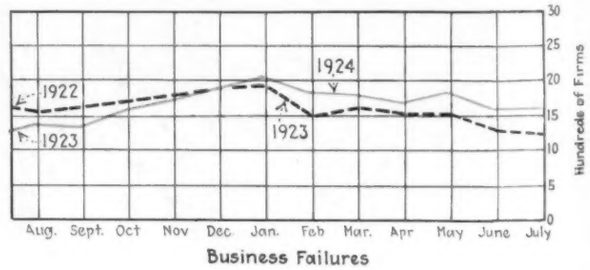
Construction Volumne Index
(Engineering-News Record)



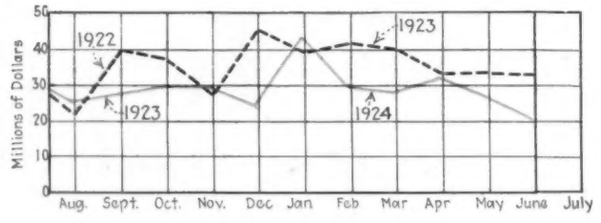
Total Average Weekly Freight-Car Loadings



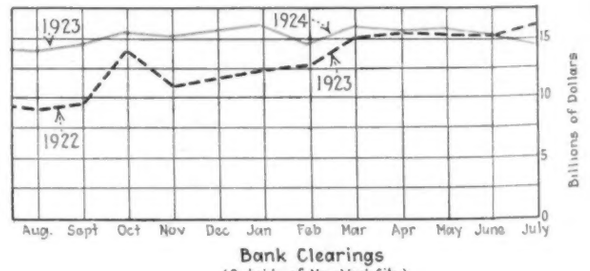
Construction Cost Index
(Engineering-News Record)



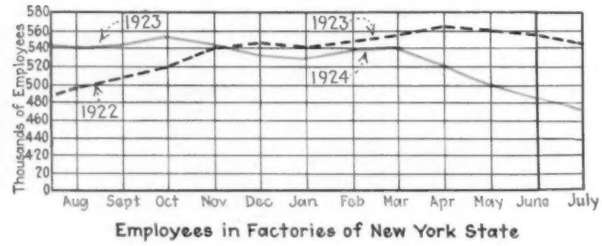
Business Failures



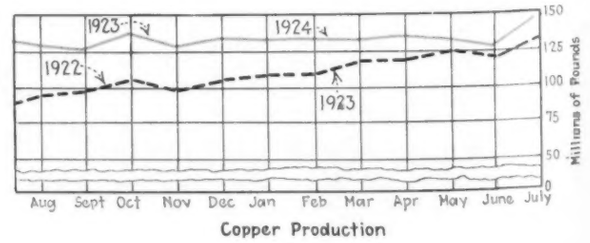
Fire Losses



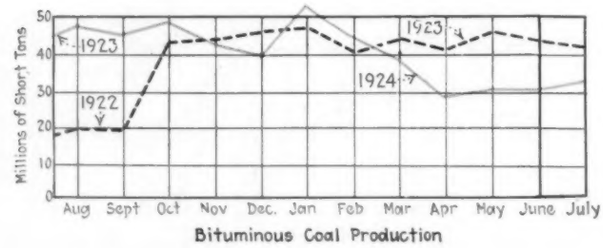
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Spirit of Optimism Prevalent

THERE remains no doubt that business conditions in general are on the up-grade. An improved sentiment has been evident for several weeks past, and while no great strides in production and consumption are expected, yet the fall should witness reasonably good business.